

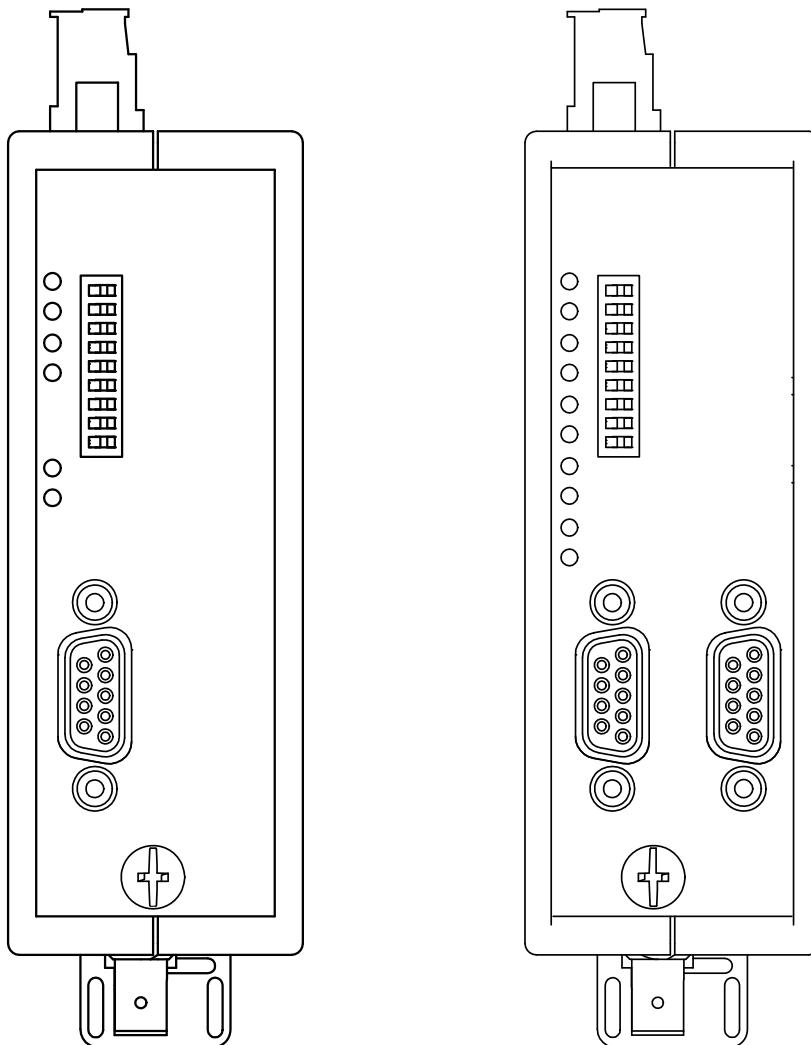


HIRSCHMANN

A **BELDEN** BRAND

User Manual

Installation Fiberoptic Repeater OZD Profi 12M ...



The naming of copyrighted trademarks in this manual, even when not specially indicated, should not be taken to mean that these names may be considered as free in the sense of the trademark and tradename protection law and hence that they may be freely used by anyone.

© 2017 Hirschmann Automation and Control GmbH

Manuals and software are protected by copyright. All rights reserved. The copying, reproduction, translation, conversion into any electronic medium or machine scannable form is not permitted, either in whole or in part. An exception is the preparation of a backup copy of the software for your own use.

The performance features described here are binding only if they have been expressly agreed when the contract was made. This document was produced by Hirschmann Automation and Control GmbH according to the best of the company's knowledge. Hirschmann reserves the right to change the contents of this document without prior notice. Hirschmann can give no guarantee in respect of the correctness or accuracy of the information in this document.

Hirschmann can accept no responsibility for damages, resulting from the use of the network components or the associated operating software. In addition, we refer to the conditions of use specified in the license contract.

You can get the latest version of this manual on the Internet at the Hirschmann product site (www.hirschmann.com).

Hirschmann Automation and Control GmbH
Stuttgarter Str. 45-51
72654 Neckartenzlingen
Germany

Contents

Safety instructions	5
About this manual	10
Key	10
1 Description	11
1.1 Non operating mode related functions	15
1.2 Operating mode related functions	16
1.2.1 Segment monitoring at the RS 485 port	16
1.3 Device views	18
1.4 Display elements	20
2 Network Topologies	24
2.1 Line topology	25
2.1.1 Line topology with optical fiber link monitoring and segmentation	26
2.1.2 Line topology without optical fiber link monitoring	27
2.2 Star topology	28
2.3 Redundant ring	30
3 Installation guidelines	32
3.1 Electromagnetic compatibility (EMC)	32
3.2 Interference suppression of switched inductances	32
3.2.1 Suppressing switched inductances with fuses	32
3.2.2 Cabinet lighting	32
3.3 Arrangement of devices and cables	33
3.3.1 Reducing interference by providing adequate space:	33
3.3.2 Standard recommendations for the arrangement of devices and cables	33
3.3.3 Using bus line shields	33
3.3.4 Shield connections	34
3.4 Laying cables inside of buildings	35
3.5 Laying cables outside of buildings	37
4 Installation	38
4.1 Checking the package contents	38

4.2	Mounting the device	39
4.2.1	Installing the device onto the DIN rail	39
4.3	Setting compatibility	40
4.4	Setting the operating mode and transmitting power	43
4.4.1	Setting the operating mode of the electrical ports (CH1, CH2)	43
4.4.2	Setting the operating mode of the optical ports (CH3, CH4)	44
4.4.3	Reducing the optical transmitting power	45
4.5	Connecting the optic bus cables	46
4.6	Connecting the electric bus cables	47
4.7	Connecting the function ground and the shield of the bus cable	49
4.8	Connecting the power supply	50
4.9	Connecting the signal contact (optional)	51
4.10	Connecting the analog voltage outputs (optional)	52
5	Configuration	54
6	Disassembly	56
7	Technical data	57
8	Scope of delivery, order numbers and accessories	61
9	Underlying technical standards	62
10	Help with problems	63
10.1	Troubleshooting	63
10.2	Systematic troubleshooting	64
10.3	Problem reporting	65
A	Further support	66

Safety instructions



WARNING

UNCONTROLLED MACHINE ACTIONS

To avoid uncontrolled machine actions caused by data loss, configure all the data transmission devices individually.

Before you start any machine which is controlled via data transmission, be sure to complete the configuration of all data transmission devices.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

■ General safety instructions

You operate this device with electricity. Improper usage of the device entails the risk of physical injury or significant property damage. The proper and safe operation of this device depends on proper handling during transportation, proper storage and installation, and careful operation and maintenance procedures.

- Before connecting any cable, read this document, and the safety instructions and warnings.
- Operate the device with undamaged components exclusively.
- The device is free of any service components. In case of a damaged or malfunctioning the device, turn off the supply voltage and return the device to Hirschmann for inspection.

■ Qualification requirements for personnel

- Only allow qualified personnel to work on the device.

Qualified personnel have the following characteristics:

- ▶ Qualified personnel are properly trained. Training as well as practical knowledge and experience make up their qualifications. This is the prerequisite for grounding and labeling circuits, devices, and systems in accordance with current standards in safety technology.
- ▶ Qualified personnel are aware of the dangers that exist in their work.
- ▶ Qualified personnel are familiar with appropriate measures against these hazards in order to reduce the risk for themselves and others.
- ▶ Qualified personnel receive training on a regular basis.

■ Certified usage

- Use the product only for the application cases described in the Hirschmann product information, including this manual.
- Operate the product only according to the technical specifications.
See “[Technical data](#)” on page 57.
- Connect to the product only components suitable for the requirements of the specific application case.

■ Device casing

Only technicians authorized by the manufacturer are permitted to open the housing.

■ National and international safety regulations

Verify that the electrical installation meets local or nationally applicable safety regulations.

■ Grounding the device

Functional grounding the device is by means of a separate connection on the device.

- Ground the device before connecting any other cables.
- Disconnect the grounding only after disconnecting all other cables.
- Ground the device via the ground screw.

■ Requirements for connecting electrical wires

- Before connecting the electrical wires, **always** verify that the requirements listed are complied with.

All of the following requirements are complied with:

- The electrical wires are voltage-free.
- The cables used are permitted for the temperature range of the application case.

Table 1: General requirements for connecting electrical wires

All of the following requirements are complied with:

- The voltage connected complies with the requirements for a safety extra-low voltage (SELV) as per IEC/EN 60950-1.
- The connected voltage is limited by a current limitation device or a fuse. Observe the electrical threshold values for the signal contact.

See “[General technical data](#)” on page 57.

Table 2: Requirements for connecting the signal contact

Requirements

All of the following requirements are complied with:

- The supply voltage corresponds to the voltage specified on the type plate of the device.
- The power supply conforms to overvoltage category I or II.
- The power supply has an easily accessible disconnecting device (e.g., a switch or a plug). This disconnecting device is clearly identified. So in the case of an emergency, it is clear which disconnecting device belongs to which power supply cable.
- The cross-section of the ground conductor is the same size as or bigger than the cross-section of the power supply cables.
- Relevant for North America:
The power cords are suitable for ambient air temperatures of at least 167 °F (75 °C). The power cord wires are made of copper.

The wire diameter of the power supply cable is at least 0.75 mm² (North America: AWG18) on the supply voltage input.

The following requirements are **alternatively** complied with:

Alternative 1	The power supply complies with the requirements for a limited power source (LPS) as per EN 60950-1.
Alternative 2	Relevant for North America: The power supply complies with the requirements as per Class 2
Alternative 3	All of the following requirements are complied with: <ul style="list-style-type: none">► The power supply complies with the requirements for a safety extra-low voltage (SELV) as per IEC/EN 60950-1.► A fuse suitable for DC voltage is located in the plus conductor of the power supply. The minus conductor is on ground potential. Otherwise, a fuse is also located in the minus conductor. Regarding the properties of this fuse: See "General technical data" on page 57.

Table 3: Requirements for connecting the supply voltage

■ Supply voltage

Only switch on the device when the housing is closed.

■ **CE marking**

The labeled devices comply with the regulations contained in the following European directive(s):

2014/30/EU (EMC)

Directive of the European Parliament and the council for standardizing the regulations of member states with regard to electromagnetic compatibility.

2011/65/EU (RoHS)

Directive of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

In accordance with the above-named EU directive(s), the EU conformity declaration will be at the disposal of the relevant authorities at the following address:

Hirschmann Automation and Control GmbH
Stuttgarter Str. 45-51
72654 Neckartenzlingen
Germany

The product can be used in the industrial sector.

- ▶ Interference immunity: EN 61000-6-2
- ▶ Emitted interference: EN 55032
- ▶ Reliability: EN 60950-1

You find more information on technical standards here:

[“Technical data” on page 57](#)

Warning! This is a class A device. This device can cause interference in living areas, and in this case the operator may be required to take appropriate measures.

Note: The assembly guidelines provided in these instructions must be strictly adhered to in order to observe the EMC threshold values.

■ **LED or laser components**

LED or LASER components according to IEC 60825-1 (2014):

CLASS 1 LASER PRODUCT

CLASS 1 LED PRODUCT

■ FCC note:

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference; (2) this device must accept any interference received, including interference that may cause undesired operation.

Appropriate testing has established that this device fulfills the requirements of a class A digital device in line with part 15 of the FCC regulations.

These requirements are designed to provide sufficient protection against interference when the device is being used in a business environment.

The device creates and uses high frequencies and can also radiate these frequencies. If it is not installed and used in accordance with this operating manual, it can cause radio transmission interference. The use of this device in a residential area can also cause interference, and in this case the user is obliged to cover the costs of removing the interference.

■ Recycling note

After usage, this device must be disposed of properly as electronic waste, in accordance with the current disposal regulations of your county, state, and country.

About this manual

The “Installation” user manual contains a device description, safety instructions, a description of the display, and the other information that you need to install the device.

Key

The symbols used in this manual have the following meanings:

▶	Listing
□	Work step
■	Subheading

1 Description

The PROFIBUS Repeaters are designed to be used in optical PROFIBUS field bus networks according to IEC 61784. They enable electrical PROFIBUS interfaces (RS 485 level) to be converted into optical PROFIBUS interfaces and vice-versa. By profiting from the familiar advantages of optical transmission technology, the repeaters can be integrated into existing PROFIBUS field bus networks. A complete PROFIBUS field bus network with repeaters in line, star or ring topology, and an arbitrary combination of these, can also be built up.

■ **Device casing**

The device is supplied in a metal housing. You have the option of mounting the device onto the DIN rail.

■ **Glass fiber technology**

The use of glass fiber transmission technology enables a very large transmission range and ensures optimal protection from EMC effects on the transmission path and – due to the potential separation – on the Repeater itself.

■ **Transmission rate**

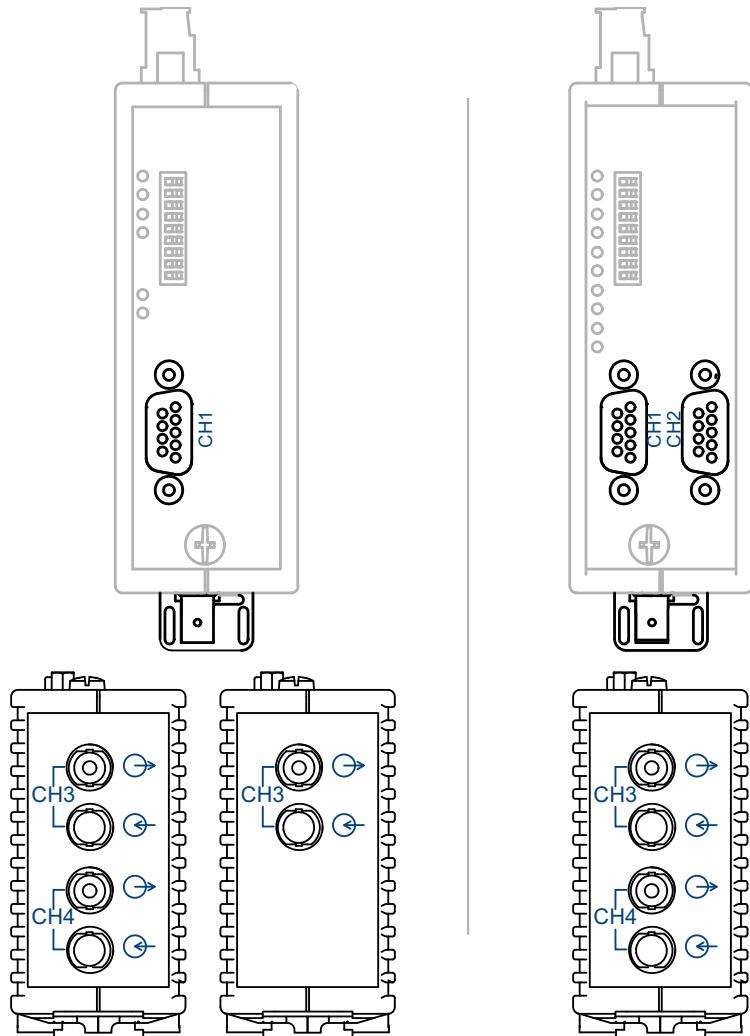
The OZD Profi 12M ... supports data rates from 9.6 kBit/s to 12 Mbit/s.

■ **Redundancy**

The redundant ring enables a very high level of transmission reliability. The redundant operating power supply can further improve the operating reliability.

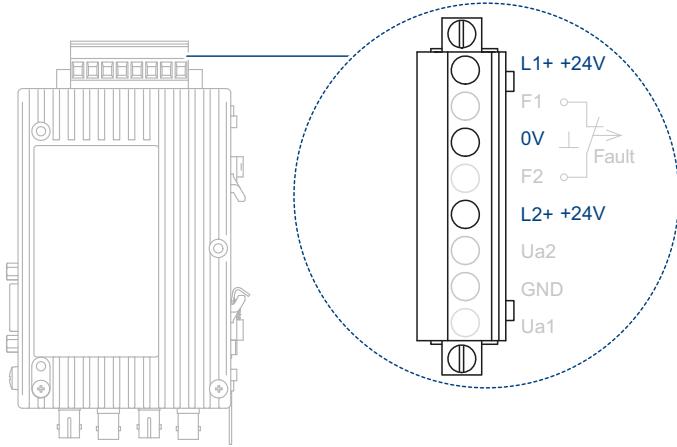
■ Port

Depending on a device variant, each device has 2,3,4 mutually independent ports (channels), which in turn consist of a transmitting and a receiving component. The electric ports are a 9-pole D-Sub socket (female). A PROFIBUS bus segment can be connected to this ports. The optical ports are BFOC/2.5 (ST ®) sockets.



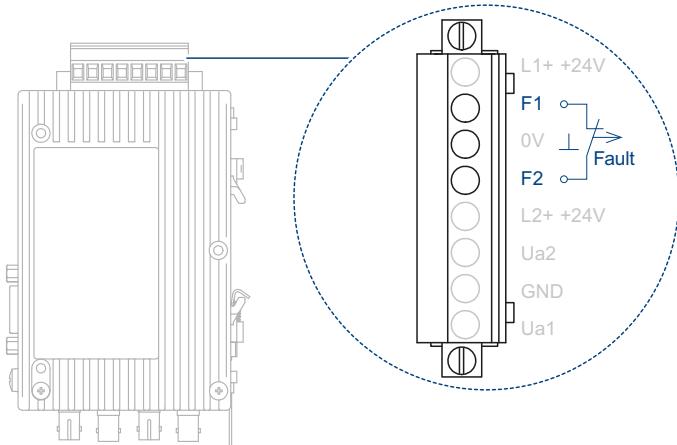
■ Power supply

The power supply is 24 V direct current. To improve the operating safety, a redundant operating power supply consisting of two separate sources can be used. For this purpose, you must connect the two supply voltages to two different terminals of the 8-pin screw-type terminal block. Both connections are uncoupled by means of diodes to prevent reverse voltage supply or destruction through incorrect pole connection. There is no load distribution between the sources. With redundant supply, the power supply unit with the higher output voltage must supply the repeater alone.



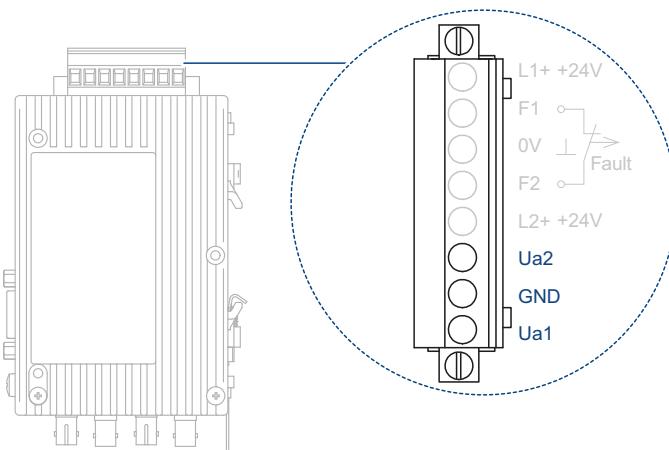
■ Signal contact

A signal contact (relay with unconnected contacts) is used to signal various disruptions in the repeaters. The signal contact is also connected to the 8-pin screw type terminal block.



■ Measuring output

One measuring output is available for each optical port. The measuring output is connected to the 8-pin screw type terminal block.



■ Configuration

You can easily set the configuration to meet your specific requirements by means of DIP switches, which can easily be operated from outside.

The following settings are possible:

- ▶ Setting the compatibility to OZD Profi ...a version
See “Setting compatibility” on page 40.
- ▶ Setting the operating mode and transmitting power
See “Setting the operating mode and transmitting power” on page 43.
- ▶ Reducing the optical transmitting power
See “Reducing the optical transmitting power” on page 45.

1.1 Non operating mode related functions

■ **Transmission rate**

The OZD Profi 12M ... support all the transmission rates defined in the EN 50170 standard:

9.6 kBit/s, 19.2 kBit/s, 45.45 kBit/s, 93.75 kBit/s, 187.5 kBit/s and 500 kBit/s and additionally 1.5 MBit/s, 3 MBit/s, 6 MBit/s and 12 MBit/s.

The transmission rate is set automatically as soon as the OZD Profi 12M ... receives a frame. The setting or adjustment is dependent on the transmission rate and the set operating mode. Depending on the OZD Profi 12M ... this can last up to several seconds.

If the transmission speed has not been recognized, the outputs of all ports are blocked. If the transmission rate changes during operation, this is detected by the repeaters, which then automatically adjust their settings accordingly.

Transfer malfunctions may temporarily occur while the rate is being altered.

■ **Signal regeneration**

The repeaters regenerate the signal form and amplitude of the data received. This allows up to 122 OZD Profi 12M ... to be cascaded (limited by the address space in PROFIBUS networks).

■ **Help when setting up**

At least one bus subscriber must be switched on and active in order to check the optical fiber connections during the installation. This bus subscriber serves as the frame source. The OZD Profi 12M ... act passively when it is switched on. They recognize the transfer rate from the frames sent by the bus subscriber. An optical help when putting the device into operation is provided by the port LED which then lights up.

1.2 Operating mode related functions

The operating mode is set using switches located on the front of the repeater. A sticker attached to the side of the repeater provides assistance with the settings. The OZD Profi 12M ... must be switched off when switching over DIP switches.

1.2.1 Segment monitoring at the RS 485 port

If the operating mode "Electric channel with segment monitoring" is set, each receiver monitors the RS 485 bus segment connected to it for faulty frames or continuously busy networks. If faulty frames are received by the receiver, or if the network is busy for longer than the maximum permitted send time, forwarding of the received signals is blocked until frames can be received again correctly, or if no signal is received for one second.

The RS 485 bus segment is not monitored in the operating mode "Electric port without segment monitoring". Interference from the electrical segment affects the entire network.

The following functions are only available for the optical channels. Whether the functions can be activated depends on the operating mode which has been set.

■ Line monitoring with echoes

The repeaters enable the connected optical paths to be actively monitored for interruptions in the fiber line by means of the functions "Send echo", "Monitor echo" and "Suppress echo".

■ Send echo

A frame which is received by a repeater via any port is transmitted to all other ports. If the receiving port is an optical port, the repeater sends the frame back to the corresponding optical sender.

■ Monitor echo

If a repeater sends a frame - no echo – to an optical port, the repeater expects to receive an echo. If the echo is not received after a predefined time, an echo monitoring error is indicated by a red LED belonging to the port.

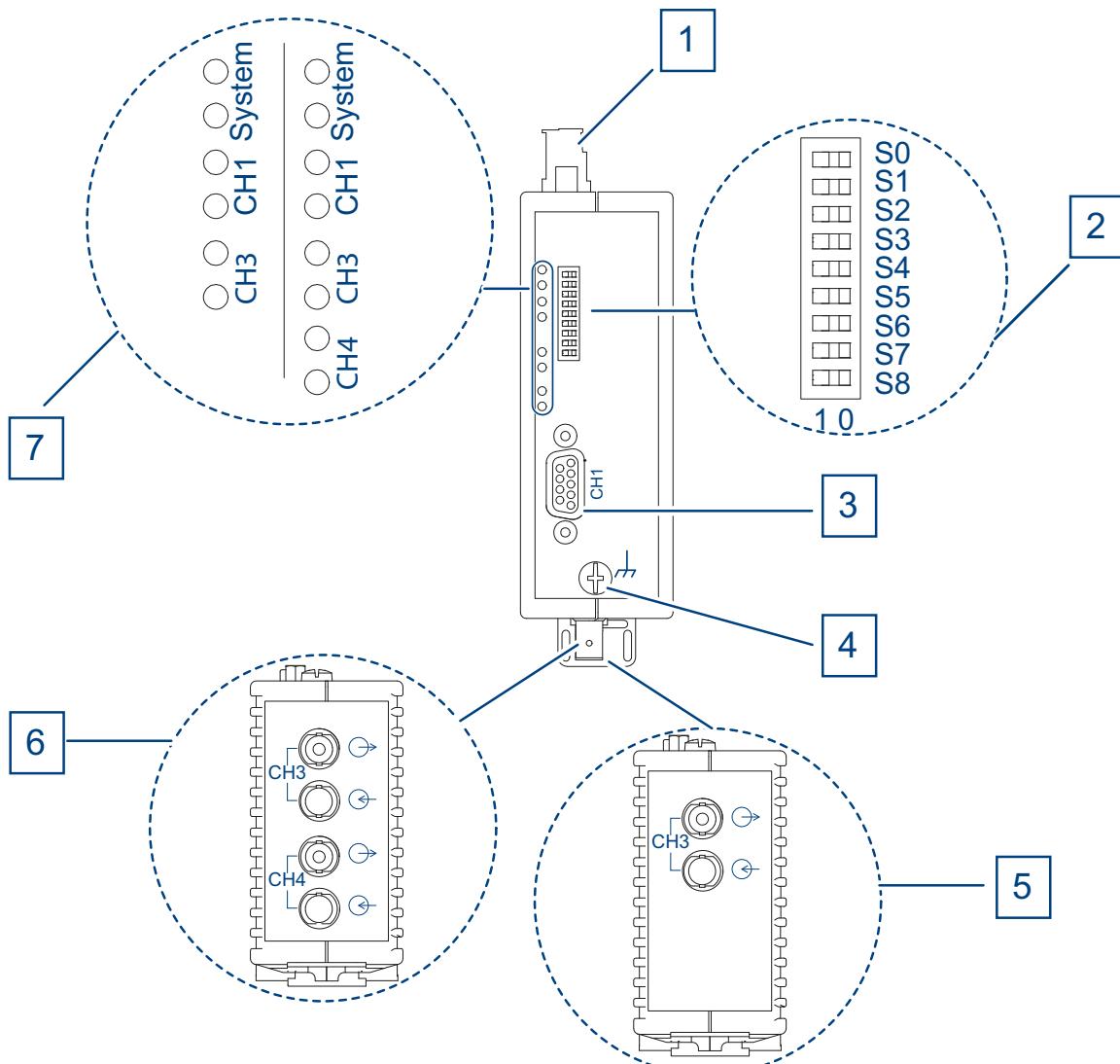
■ Suppress echo

The relevant receiver is separated from the other ports from the moment a frame is sent until the echo has been received correctly.

■ **Segmentation**

If an echo monitoring error or a frame falsification arises at an optical port, the repeater assumes that the line is faulty and blocks this port for user data. The connected field bus partial network is then segmented (cut off). This segmentation causes the repeater at the other end of the optical fiber to be segmented as well. Both repeaters connected to the segmented field bus partial network send test frames to the segmented ports. These test frames – which are to be received regularly – can be used by both repeaters to check the status of the field bus partial network. The segmentation is automatically lifted as soon as the test frames indicate to both repeaters that the segmented field bus partial network is no longer disturbed. If all active bus subscribers are deactivated in a previously active network, the repeaters are segmented cyclically in order to check the fiber links to the neighboring repeaters. If there is no frame traffic, but the fiber links are intact, the port LEDs of the optical ports flash yellow cyclically.

1.3 Device views



Front view using example of device variants OZD Profi 12M ...

- **G11/G11-1300**
- **G12/G12-1300/G12-EEC/G12-1300-EEC**
- **P11/P12**

1 8-pin terminal block for power supply, signal contact, measuring output

2 8-pin DIP switch

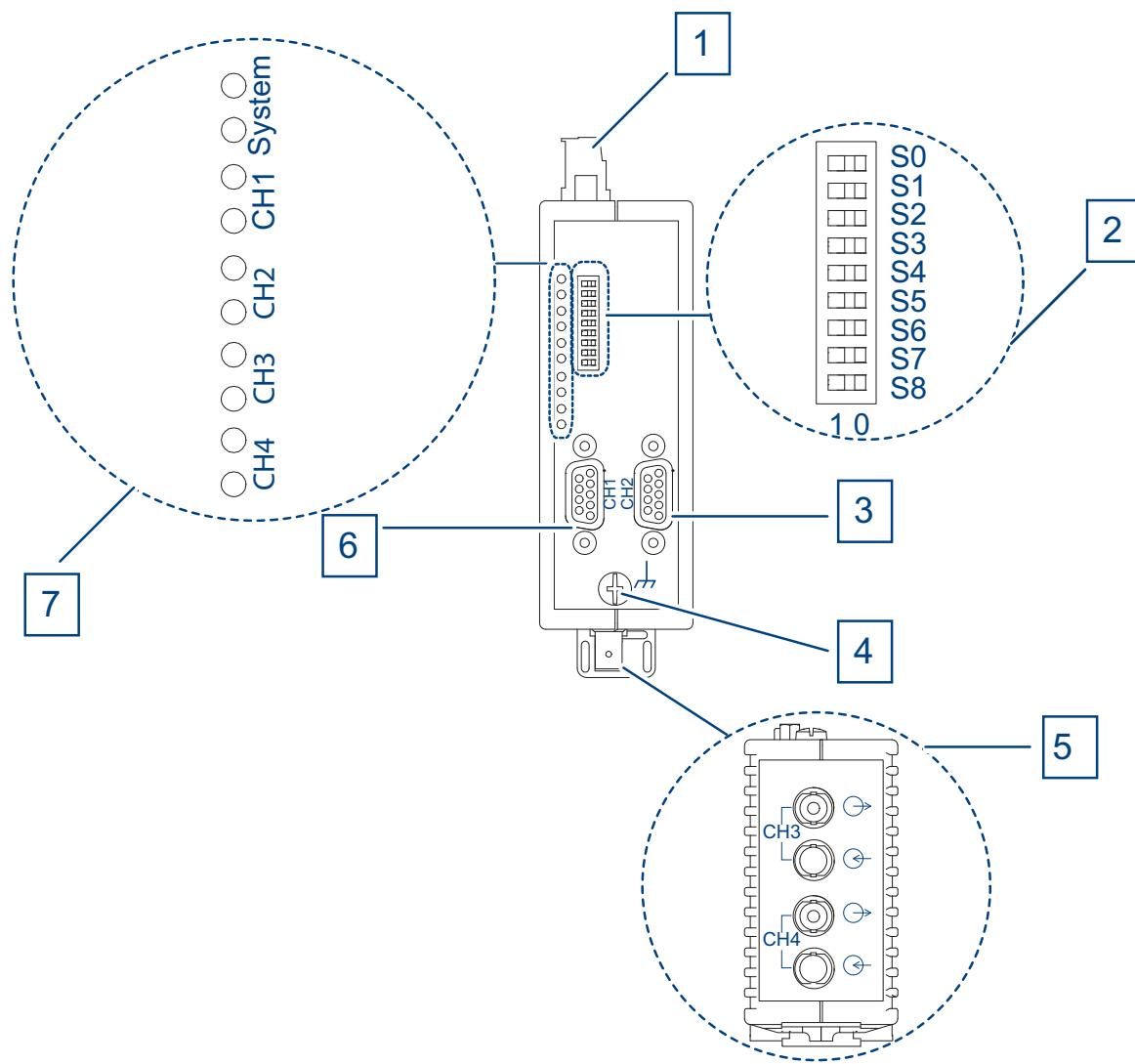
3 CH1 - electrical port

4 Grounding screw

5 CH3 - optical port
(only applies to the device variants OZD Profi 12M ... G11, G11-1300, P11)

6 CH3, CH4 - optical ports
(only applies to the device variants OZD Profi 12M ... G12, G12-1300, G12 EEC, G12-1300 EEC, P12)

7 LED display element for system status and port status

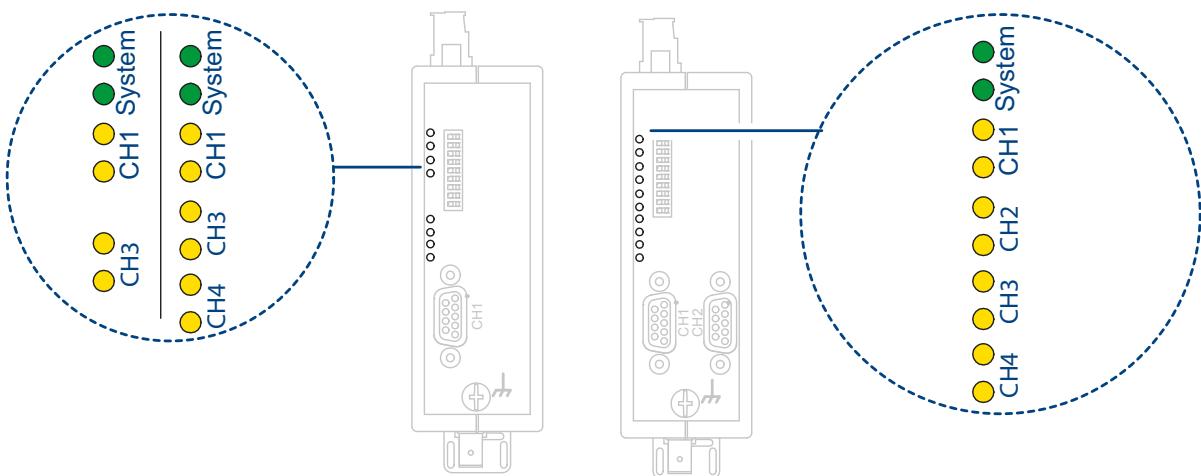


Front view using example of device variants OZD Profi 12M ...

- **G22/G22-1300/G22-EEC/G22-1300-EEC**
- **P22**

- 1 8-pin terminal block for power supply, signal contact, measuring output
- 2 8-pin DIP switch
- 3 CH2 - electrical port
- 4 Grounding screw
- 5 CH3, CH4 - optical ports
- 6 CH1 - electrical port
- 7 LED display element for system status and port status

1.4 Display elements



LED	Color	Meaning
System	green	lights up The transmission rate has been recognized and the power supply is in order
	red	Signal contact: no signal flashes Transmission rate has not yet been recognized <ul style="list-style-type: none"> – No transmitting bus subscriber present – No connection to a partner repeater sending frames – Send and receive optical fibers have been transposed. – Transmission rate does not correspond to PROFIBUS-DP. – Only one active bus subscriber is connected, which is only sending tokens to itself. The indicator must switch over after a second bus subscriber has been activated (token frames on their own are not enough to set the transfer rate). – The connected RS 485 segment is only terminated at one end.
	red/green	Signal contact: no signal flashes Transmission rate recognized but <ul style="list-style-type: none"> – the network slot time could not be determined (network parameter HSA is set too low, no transmitting bus subscriber present) – one optical port is set to "Redundant optical ring" mode, but not the second (this operating mode must always be set at both optical ports) – the slot time of the network configuration is too short
	none	Signal contact: no signal – Power supply has failed (total failure). Failure of both power supply sources with redundant infeed. – Power supply connected incorrectly – Repeater defective
		Signal contact: signal

LED	Color		Meaning
electrical ports	yellow	lights up	<p>Signals are being received on the RS 485 bus line.</p> <p>Signal contact: no signal</p>
	red	flashes/light s up	<p>Sporadic interference signals because</p> <ul style="list-style-type: none"> – the RS 485 bus line being insufficiently shielded – an open RS 485 bus line, i.e. it is only connected to the repeater at one end – the RS 485 segment is not terminated or only terminated at one end – an RS 485 bus terminal or terminal connector has been plugged in/ pulled out <p>Signal contact: signal</p> <p>Permanent interference because</p> <ul style="list-style-type: none"> – conductors A and B in the RS 485 bus line have been transposed – of an RS 485 bus line short circuit – the send time has been exceeded caused by a bus subscriber in a bus segment connected to Port 1 (CH1) <p>Signal contact: signal</p> <ul style="list-style-type: none"> – repeater and another bus subscriber connected via Port 1 (CH1) are both sending at the same time (e.g. because an address has been assigned twice, the setting of the slot time is too low, or during lifting of the segmentation in the optical lin). <p>Signal contact: no signal</p> <ul style="list-style-type: none"> – RS 485 driver of the repeater is defective (e.g. after lightning strike)
	none		<ul style="list-style-type: none"> – Bus subscriber is not connected – Connected bus subscriber is not switched on – One or both conductors in the RS 485 bus line is broken <p>Signal contact: no signal</p>
Operating mode "Line with optical fiber link monitoring" and "Redundant optical ring"			
optical ports	yellow	lights up	<p>PROFIBUS frames are being received at the optical port</p> <p>Signal contact: no signal</p>
		flashes	<p>Transmission rate has been recognized – LED "System" lights green or flashes red/green.</p> <ul style="list-style-type: none"> – No transmitting bus subscriber present (optical fiber connection is OK) <p>Signal contact: no signal</p>

LED	Color	Meaning
red	lights up	<ul style="list-style-type: none"> – Send and receive optical fibers have been transposed. – No partner repeater connected or partner repeater is not switched on. – Connected partner repeater is defective – Send time of connected partner repeater has been exceeded – An optical fiber line is broken – Optical fiber link to partner repeater is too long – Loose connection in an optical fiber connector – Optical fiber in the optical fiber connector is loose. – When using a redundant optical ring: if a fault in the optical fiber has been corrected but the port LEDs on both of the OZD Profi concerned still light red, check whether parameter HSA has been set as described in the chapter "Redundant Ring". – Send and receive optical fibers have been transposed. <p>Signal contact: open</p>
	red/yellow flashes	<ul style="list-style-type: none"> – Fault occurs periodically (see above) – Loose connection in an optical fiber connector – Optical fiber in the optical fiber connector is loose – Only one active bus subscriber is connected, which only sends tokens to itself. A fault should not be signaled as soon as a second subscriber is activated. <p>Signal contact: signal</p>
none		<p>Transmission rate has not yet been recognized – LED "System" flashes red</p> <ul style="list-style-type: none"> – No transmitting bus subscriber present – Send and receive optical fibers have been transposed – No partner repeater connected or partner repeater is not switched on – Connected partner repeater is defective <p>Transmission rate has been recognized - LED "System" flashes green</p> <ul style="list-style-type: none"> – If the operating mode "Redundant optical ring" has been set, the optical port works as a stand-by port. There is no malfunction in the OZD Profi 12M ... or the optical fiber. – If one of the operating modes "Line with optical fiber link monitoring ..." has been set, no PROFIBUS frames are received at the optical port. There is no malfunction in the OZD Profi 12M ... or the optical fiber. <p>Signal contact: no signal</p>
Operating mode "Line without optical fiber link monitoring"		

LED	Color	lights up	Meaning
optical ports	yellow		<p>Signals are received at the optical channel.</p> <p>Signal contact: no signal</p>
	none		<ul style="list-style-type: none"> – No transmitting bus subscriber present – Send and receive optical fibers have been transposed – No partner repeater connected or partner repeater is not switched on – Connected partner repeater is defective <p>Signal contact: no signal</p>

2 Network Topologies

The following network topologies can be realized with the OZD Profi 12M ...:

- ▶ Point-to-point connections
- ▶ Line topologies
- ▶ Star topologies
- ▶ Redundant optical rings

Note:

- ▶ Single terminals or entire PROFIBUS segments with max. 31 subscribers can be connected to the electrical interface of the OZD Profi 12M ...
- ▶ In areas with a high EMC incidence, only lay optical fiber lines in order to exclude the possibility of EMC affecting the whole network.
- ▶ Optically only OZD Profi 12M ... of the same type can be connected together: OZD Profi 12M P11 with ... P12, OZD Profi 12M G11 with ...G12 and ...G12 EEC, OZD Profi 12M G11-1300 with ... G12-1300 and ...G12-1300 EEC.
- ▶ Optical ports which are connected by optical fiber must be set to the same operating mode.
- ▶ Junctions between different OZD Profi 12M ... types are only possible via the RS 485 interface.
- ▶ OZD Profi 12M G12 (-1300) EEC can be used everywhere in those network topologies described below in which a OZD Profi 12M G12(-1300) can also be used.

2.1 Line topology

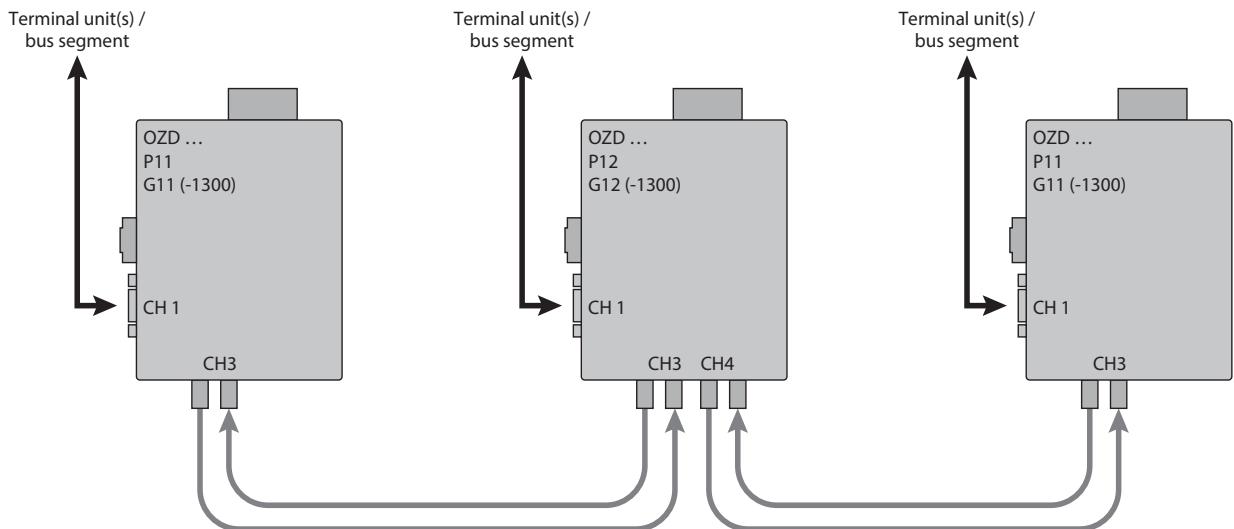


Figure 1: Network structure in an optical line topology

In a line structure, the individual OZD Profi 12M ... are connected together by dual-fiber optical fibers. Repeaters with one optical port are sufficient at the beginning and end of a line, between which repeaters with two optical ports are necessary.

If single point-to-point connections are to be built up, this can be achieved using two repeaters each with one optical port.

The line topology can be realized with and without fiber link monitoring. If both operating modes are used within an optical fiber line, the operating mode "Line topology without fiber link monitoring" determines the availability of this fiber line. It is recommended that fiber link monitoring be used in homogeneous OZD Profi networks (default factory setting).

Please note that the following ambient conditions must be fulfilled to ensure that network configuration functions correctly:

- ▶ The parameters $\text{MIN } T_{\text{SDR}}$ described in the PROFIBUS standard EN 50170 must be set to a value ≥ 11 on all terminals. This is usually the case, but the setting should be checked if communication malfunctions continuously arise.
- ▶ When configuring your network, select low bus subscriber addresses wherever possible. This ensures that master timeout times which may arise are kept as short as possible in the event of a malfunction.

2.1.1 Line topology with optical fiber link monitoring and segmentation

This operating mode should preferably be used if an interrupted fiber segment is to be separated from the rest of the network.

Monitoring mechanisms	
Send echo	yes
Monitor echo	yes
Suppress echo	yes
Monitor	yes
Segmentation	yes

In this operating mode the individual fiber links are monitored by the two connected repeaters.

If a repeater fails, an optical fiber breaks or faults are determined on the optical transfer link, the fiber link between the two Fiberoptic Repeater is interrupted (segmented).

The PROFIBUS network is divided into two partial networks, which remain functional independently of one other. The malfunction is indicated at the two OZD Profi 12M ... that are connected to the malfunctioning fiber link by the port LEDs switching to red and by activation of the signaling contacts. The segmentation is lifted automatically as soon as both repeaters recognize that the field bus network is functioning correctly with the help of test frames.

Please note that in the case of networks with several active bus subscribers, two logical token rings are formed in the event of an error. Every time the partial networks are switched together, network malfunctions may arise due to the double tokens or frame collisions.

Note: If a repeater with two optical channels is used at the beginning or end of a line, the optical port which is not assigned must be switched to the operating mode "Line without fiber link monitoring", so that it does not signal a break in the fiber line. Please note that optical ports which are not connected must always be fitted with protective caps to guard against extraneous light and dirt.

2.1.2 Line topology without optical fiber link monitoring

Use this operating mode if you connect a OZD Profi 12M ... with another optical fiber network component, which does not send a frame echo and does not expect or is not compatible with a frame echo in accordance with PROFIBUS guidelines (optical/electrical converter).

Monitoring mechanism	
Send echo	no
Monitor echo	no
Suppress echo	no
Monitor	no
Segmentation	no

Individual fiber links are not monitored in this operating mode.

2.2 Star topology

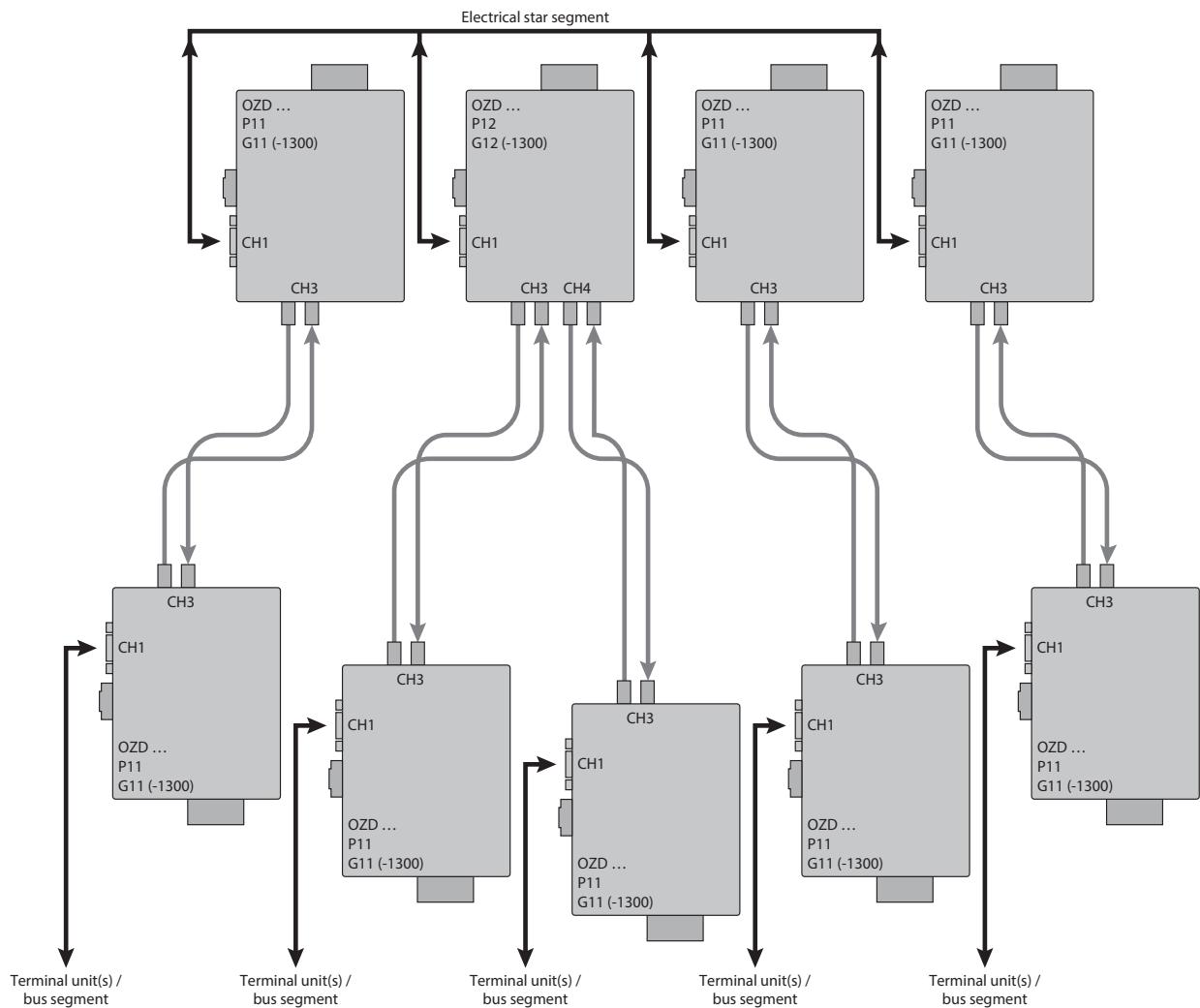


Figure 2: Network structure in an optic star topology

Several repeaters are combined to form an active PROFIBUS star coupler. Other repeaters are connected to this by dual-fiber optical fiber lines. The repeaters of the star coupler are connected to one another via the electrical port (electrical star segment). All OZD Profi 12M ... types for different fiber types (plastic, PCF, glass) can be combined using the electrical star segment.

- ▶ CH1 in mode "Monitor off" (S0 = 1) must be activated on all OZD Profi 12M ... which are connected to the electrical star segment. This deactivates the segmenting function of the RS 485 port on these OZD Profi 12M ..., providing a high degree of availability of the electrical star segment.
- ▶ Ensure that the electrical star segment is wired carefully. Keep it as small as possible to avoid interference injection into the electrical star segment, and from here into the entire network. This can be achieved by laying out the OZD Profi 12M ... in the electrical star segment directly next to each other on a hat rail.
- ▶ Switch on the terminating resistors in the bus port connectors at both ends of the electrical star segment.
See "[Connecting the electric bus cables](#)" on page 47.
- ▶ Do not connect a bus subscriber to the electrical star segment wherever possible.
- ▶ This applies exclusively to device variants OZD Profi 12M x22: Connect other bus subscribers to the second electrical port (CH2).

Repeaters with one or two optical ports can be used to create an active PROFIBUS star coupler. Repeaters with one optical port are sufficient for connecting a terminal or an RS 485 bus segment to the active star coupler. If the link monitoring on the optical ports is activated, the fiber optic links are monitored by the respectively connected OZD Profi 12M

Note: Optical ports which are not assigned (for instance, because they are reserved for a future system extension) indicate a fiber break if the link monitoring is activated. You can prevent this error report from being issued by activating the operating mode "Line without fiber link monitoring" at the non-assigned ports. Please note that optical ports which are not connected must always be fitted with protective caps to guard against extraneous light and dirt.

2.3 Redundant ring

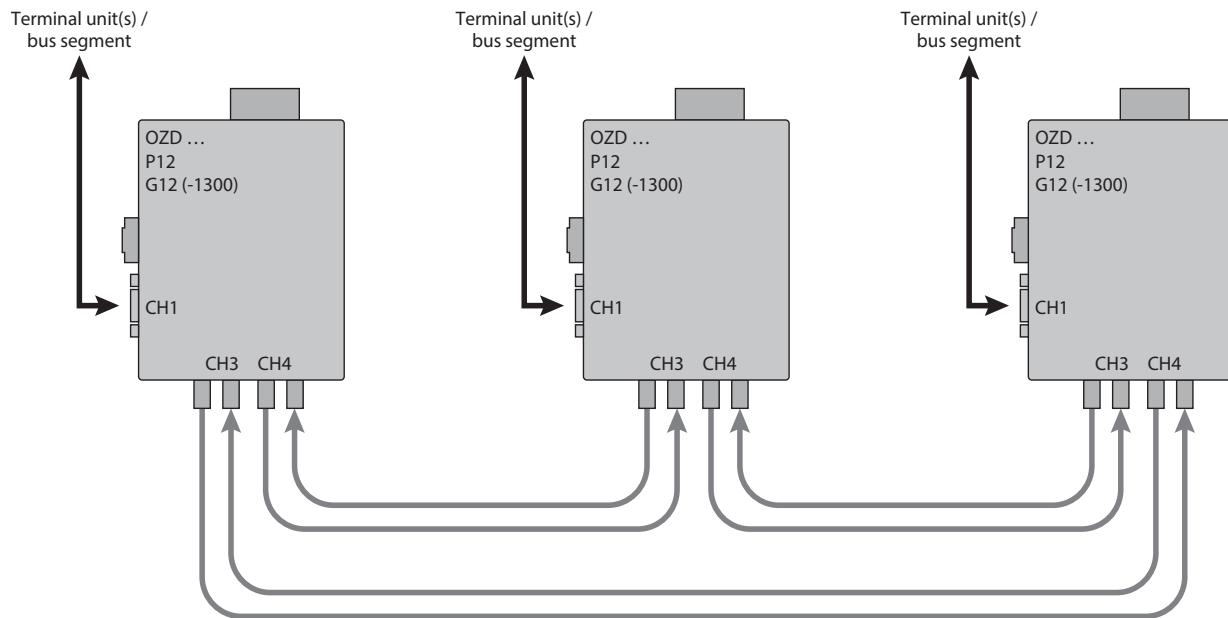


Figure 3: Network structure in a redundant optical ring topology

This network topology represents a special form of line topology. A high degree of network operating safety is achieved by "closing" the optical line. A redundant optical ring can only be realized with repeaters with two optical ports of the same fiber.

Monitoring mechanism	
Send echo	yes
Monitor echo	yes
Suppress echo	yes
Monitor	yes
Segmentation	yes

An interruption of one or both optical fibers between two repeaters is detected by the OZD Profi 12M ... and the ring is transformed into an optical line.

If one repeater fails only those terminals connected to this repeater or the RS 485 segment are uncoupled from the ring. The remainder of the network itself continues to function as a line. The error is indicated by the LEDs on the two OZD Profi 12M ... connected to the malfunctioning optical fiber and their signaling contacts. The segmentation is lifted automatically as soon as both repeaters recognize that the segmented field bus network is functioning correctly with the help of test frames. The line forms itself into a ring.

The following ambient conditions must be fulfilled to ensure that the network configuration functions correctly:

- ▶ The operating mode "Redundant optical ring" must be set at both optical ports of all the OZD Profi 12M
- ▶ All repeaters in a ring must be connected to one another by fiber lines. The ring may not include an RS 485 bus line.
- ▶ The parameter $\text{MIN } T_{\text{SDR}}$ described in the PROFIBUS standard EN 50170 must be set to a value ≥ 11 on all terminals. This is usually the case, but the setting should be checked if communication malfunctions continuously arise.
- ▶ When configuring your network, select low bus subscriber addresses wherever possible. This ensures that master timeout times which may arise are kept as short as possible in the event of a malfunction.
- ▶ If a redundancy case occurs (e.g. a line break), there is a switching time during which data can not be correctly transmitted. In order to ensure a smooth transition, it is recommended that the frame repeat setting (Retry) on the PROFIBUS master be set to at least 3.
- ▶ After the error has been corrected, no frames should be present in the network when the optical line is transformed back into an optical ring to ensure that the process is completed smoothly. This condition can arise when a master selects a device whose address has been configured, but which does not physically exist.

The master tries to address this device cyclically and waits for a reply only until the configured slot time has been exceeded ("GAP request"). The OZD Profi 12M ... recognizes this condition and closes the optical line to an optical ring in the middle of this request sequence. This results in two configuration requirements for the redundant optical ring:

- The value of the parameter HSA (Highest Station Address) must be set at all terminals so that between the bus address 0 and the value HSA at least one address in the network has not been assigned to a bus subscriber, i.e. so that there is at least one address gap. This address gap can also be created by simply setting the value of the parameter HSA so that it is at least one greater than the highest number of subscriber bus addresses present in the network.

Note: If this requirement is not or no longer fulfilled, the optical line will no longer be closed into a redundant optical ring after segmentation. The error report (LED and signaling contact) of the two affected OZD Profi 12M ... is not cancelled even after the error has been corrected.

- The slot time must be set to approximately twice the value required in a non-redundant network. Refer to the manufacturer's documentation provided with the terminal or configuration software for details about how to adjust the settings.

3 Installation guidelines

3.1 Electromagnetic compatibility (EMC)

Electromagnetic compatibility (EMC) covers all aspects regarding the effects of radiated and received electrical, magnetic, and electromagnetic emissions. In order to prevent interference in electrical systems, these effects must be reduced to a minimum. The structural design and correct connection of bus lines as well as the interference suppression of switched inductances play a major role in limiting interference.

3.2 Interference suppression of switched inductances

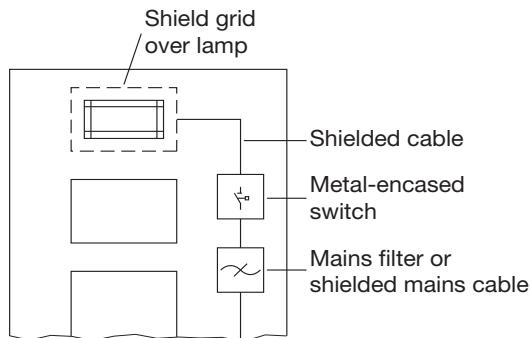


Figure 4: Interference suppression of fluorescent lamps in cabinet

3.2.1 Suppressing switched inductances with fuses

Switching inductances, e.g. in relays and fans, generates interference voltages which are many times higher than the switched operating voltage. These interference voltages can affect electronic devices. The interference voltages of inductances must be limited at their source of emission by means of fuses (by connecting diodes or RC elements). Only use interference suppressors which are intended for the used relays and fans.

3.2.2 Cabinet lighting

- Use filament lamps (e.g. LINESTRA lamps) for the cabinet lighting.
- Do not use fluorescent lamps because they generate interference fields.
If the use of fluorescent lamps cannot be avoided, the interference suppression measures shown in Fig. 4 must be implemented.

3.3 Arrangement of devices and cables

3.3.1 Reducing interference by providing adequate space:

A simple yet effective way of reducing interference is to separate devices and cables causing interference from those affected by interference. Inductive and capacitive interference injection decreases by the square of the distance between the elements concerned. This means that doubling the distance reduces the interference by a factor of 4. If the arrangement of the various elements in a building or in the switch cabinet is taken into consideration at the planning stage, the cost of the necessary interference suppression measures is generally very low.

Note: Between an OZD Profi 12M ... and a power switching element (e.g. contactor, relay, temperature regulator, switch, etc.) a minimum separation of 5.9 in (15 cm) is to be maintained. This minimum separation is to be measured between the outer edges of the components and in all directions around OZD Profi 12M The power supply wires (24 V DC and 0 V) for the OZD Profi 12M ... must not be laid in the same cable duct as cables for load circuits. The wires (24V DC and 0 V) should be twisted together.

3.3.2 Standard recommendations for the arrangement of devices and cables

EN 50174–2 contains recommendations for arranging devices and cables which are aimed at reducing mutual interference to a minimum.

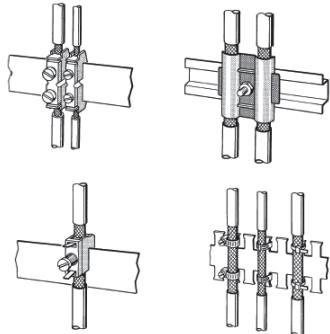
3.3.3 Using bus line shields

It is important to observe the following when shielding bus lines:

- Use only fully shielded PROFIBUS lines. The shields of these lines must be of sufficient thickness to satisfy the legal requirements for interference radiated and interference received.
- Always attach the shields at both ends of the bus lines. The legal requirements vis-à-vis interference radiated and interference received for your system will only be satisfied if shields are connected at both ends (CE symbol).
- Attach the shield for the bus line at the connector plug housing or at the cable clamps provided.
- In the case of steady-state operation, it is advisable to strip the shielded line entirely and connect it with the shielding bus/protective conductor rail.

Note: If differences in potential occur between the grounding points, an inadmissibly high compensating current could flow across the shielding connected at both ends. Never eliminate this problem by removing the shielding from the bus line. The following solution is permissible: Lay an additional equipotential bonding cable parallel to the bus line. This additional cable will carry the shield current.

3.3.4 Shield connections



Proceed as follows:

- Secure the shield braid using metal cable clamps.
- The clamps must fully enclose the shield and make good contact.
- Only connect the lines via the copper braid shield, and not via the aluminum foil shield. One side of the foil shield is attached to a plastic film to increase its tearing strength, and is therefore non-conductive.
- The shields of all cables which are routed into a cabinet from the outside must be clamped at the point of entry inside the cabinet and connected to the cabinet ground with a large contact surface area.
- When removing the cable jackets, it is important to ensure that the braid shield of the cables is not damaged. Tin-plated or galvanically stabilized surfaces are ideal for optimum contacting between grounding elements. With zinc-plated surfaces, suitable threaded connections must be provided for the required contacts. Painted surfaces at the contact points are unsuitable.
- Shield clamps/contact points should not be used as strain relief devices. Contact with the shield bus could otherwise deteriorate or break completely.

3.4 Laying cables inside of buildings

Laying cables within control cabinets

If a repeater is installed within a control cabinet, the cable shield of the incoming bus cable should be electrically connected to a grounding rail as close as possible to the cable lead through using a shield grounding clamp or similar. The cable shield should continue within the cabinet to the fieldbus device and be connected there in accordance with the manufacturer's instructions.

Laying cables outside of control cabinets

PROFIBUS cables and cables for DC and AC voltages > 400 V (unscreened), areas with explosion hazard and telephone cables separate cable runs spaced at least 10 cm apart. All cable ducts should be constructed of electrically conducting material and connected to functional ground at regular intervals. Bus cables should not be subject to mechanical loads which exceed the manufacturer's specifications. If this cannot be avoided, additional protective measures should be taken, e.g. by laying the cables in a steel pipe or rugged metal duct. The pipe or duct should then be grounded at regular intervals and protected against corrosion.

■ Potential equalization and screening

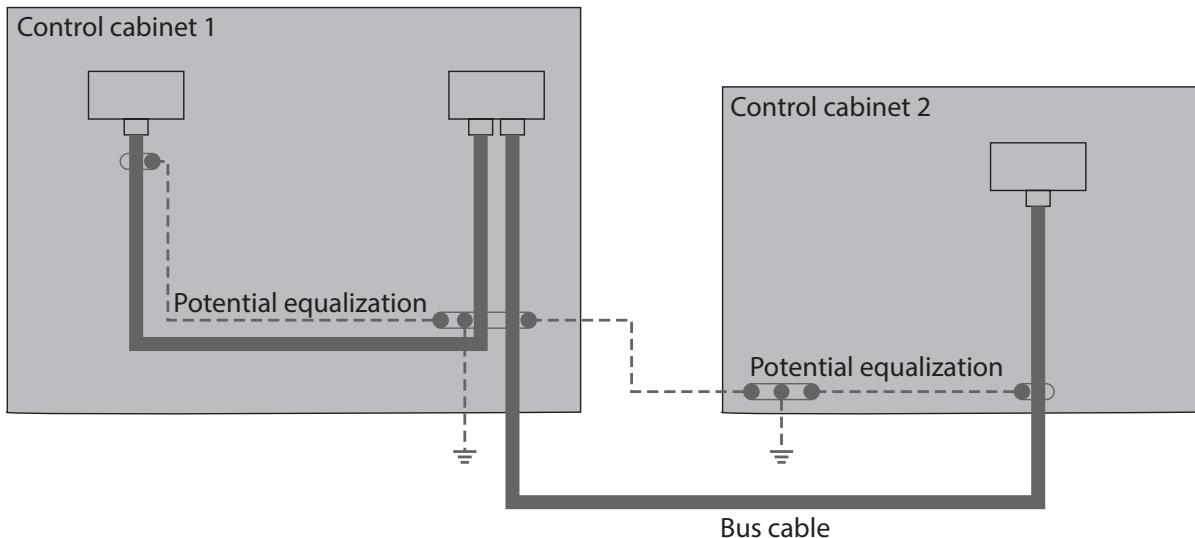


Figure 5: Laying cables inside of buildings

The cable screen should be connected to ground at both ends of the cable. The use of fiber optic cable is recommended if problems are experienced with interference. A low impedance potential equalization cable should be used if this is not possible. Situations where interference can present a problem include: plant which extends over a large area, power is fed to the plant from different power sources, networking extends over several buildings. If one of these situation apply, the following should be observed when installing the potential equalization system:

- ▶ The circuit through which interference signals flow must be closed.
- ▶ Each part of the plant must be electrically connected to the potential equalization system/functional ground at as many places as possible. Electrically conducting pipes, parts of machines or supporting structures should be integrated in the potential equalization system. In order to ensure long-term reliability, appropriate measures should be undertaken to protect against corrosion.
- ▶ The potential equalization cable must be protected against corrosion.
- ▶ The cross-section of the potential equalization cable should be chosen with regard to the maximum potential equalization currents which can flow.

Special care should be taken when installing potential equalization cables to maximize the interference immunity of the data cables. If possible, the potential equalization cable should be laid parallel to and as close as possible to the data cable (preferably in the same plastic pipe). The cable screen should never be used for potential equalization. The potential equalization cable should be finely stranded to ensure that it is also effective at high frequencies as a result of the large surface area.

3.5 Laying cables outside of buildings

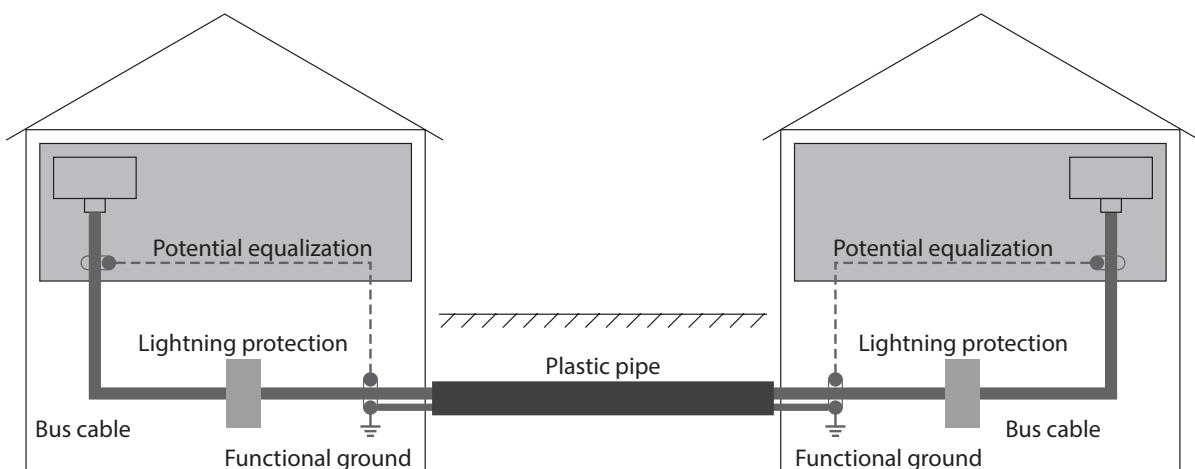


Figure 6: Laying cables outside of buildings

Requirements:

- It is recommended to use fiber optic cables for bus installations which are outside of buildings. In the case of bus cables between buildings which are laid in the ground, you should use a special fiber optic cable type which is suitable for this application.
- Suitable copper cable types can be used if fiber optic cables cannot be used.
- Observe the admissible minimum and maximum temperature rating for the type of cable used.

In principle, the same rules apply to laying cables outside of buildings as within buildings. However, for outside installation, the cables should be provided with additional protection by laying them inside a suitable plastic pipe.

The transition from external to internal cables should always use an auxiliary terminal block. It is used to interconnect the cable for burial in the ground with the standard bus cable. Lightning arrestors should be installed directly where the cable enters the building. In addition, the auxiliary terminal block should contain appropriate circuits to protect against overvoltages (lightning protection).

4 Installation

The devices have been developed for practical application in a harsh industrial environment.

Hirschmann supplies the device ready for operation.

To configure a subdomain, follow these steps:

- [Checking the package contents](#)
- [Mounting the device](#)
- [Setting compatibility](#)
- [Connecting the optic bus cables](#)
- [Connecting the electric bus cables](#)
- [Connecting the function ground and the shield of the bus cable](#)
- [Connecting the power supply](#)
- [Connecting the signal contact \(optional\)](#)
- [Connecting the analog voltage outputs \(optional\)](#)

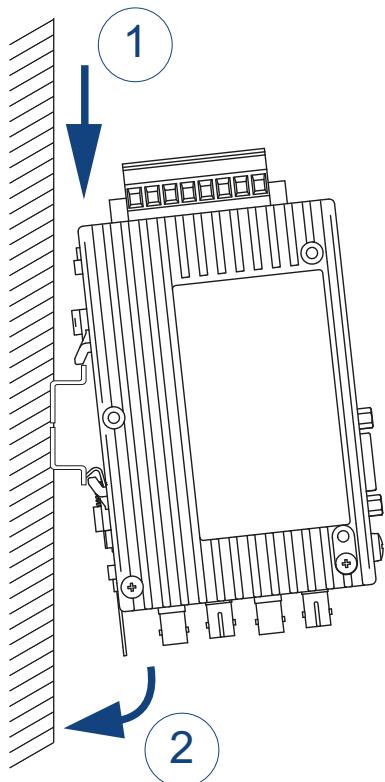
4.1 **Checking the package contents**

Proceed as follows:

- Check whether the package includes all items named in the section [“Scope of delivery” on page 61](#).
- Check the individual parts for transport damage.

4.2 Mounting the device

4.2.1 Installing the device onto the DIN rail



Note: The device is for mounting on a 35 mm DIN rail in accordance with DIN EN 60715.

Requirements:

- ▶ Install the device in a location where the climatic threshold values specified in the technical data are adhered to.
See “[Technical data](#)” on page 57.
- ▶ Ensure that there is sufficient room to connect the bus and power supply cabling.
- ▶ Connect the optical fiber line before mounting the repeater as this simplifies the procedure.

Proceed as follows:

- Slide the upper snap-in guide of the device into the DIN rail.
- Press the device downwards onto the clip-in bar.

4.3 Setting compatibility

Note: The functional compatibility on **OZD Profi 12M ...^a** is switched on or switched off with the DIP switch S8.

- When operating **OZD Profi 12M ...^a** with **OZD Profi PRO** or with previous **OZD Profi 12M ...^b** the functional compatibility must be switched off (S8=0). The devices are directly compatible.
- When operating **OZD Profi 12M...** with **OZD Profi G3a, ... G4a, ... G3a-1300, ... G4a-1300, ... P3a, ... P4a** the functional compatibility must be switched on (S8=1).

Only turn switch S8 to Position 1 if the **OZD Profi 12M ...^a** is being used as a spare or expansion device in existing networks in conjunction with these devices and a direct optical connection is to be made. The following tables show the switch assignment:

- Device variants with 1 or 2 electrical ports (CH1, CH2),
DIP switch: S0 - S8
- Device variants with 1 electrical port (CH1) only,
DIP switch: S0 - S7

OZD Profi G3a... / G4a...			OZD Profi 12M G... ^a	
Meaning of the DIP switches	DIP switch	Function	DIP switch	Function
S1 - Mode	S1 = 0	Mode 0	S2=0	Mode 0
	S1 = 1	Mode 1	S2=1	Mode 1
S2 - Redundancy function	S2 = 0	OFF	S3=0	OFF
	S2 = 1	ON	S3=1	ON
S3 - Termination	S3 = 0	CH2 not terminated	-	not relevant (Termination extern)
	S3 = 1	CH2 terminated	-	not relevant (Termination extern)
S4 - Termination	S4 = 0	CH2 not terminated	-	not relevant (Termination extern)
	S4 = 1	CH2 terminated	-	-
S5 - optical Power / Distance	S5 = 0	Network configuration: Standard	S4=0	Network configuration: Standard
	S5 = 1	Network configuration: Extended	S4=1	Network configuration: Extended
S6 - optical Power	S6 = 0	Without function	-	-
	S6 = 1	Without function	-	-
			S8 =1	Compatibility ON
			S0, S5 = 0	Without function
			S6, S7 = 0	in Position = 0

Table 4: Switch assignment of the OZD Profi 12M ... at S8=1 as a spare or expansion device for OZD Profi G3a, ...G4a, ...G3a-1300 and...G4a-1300.

OZD Profi P3a... / P4a...			OZD Profi 12M G... ^a	
Meaning of the DIP switches	DIP switch	Function	DIP switch	Function
S1 - Mode	S1 = 0	Mode 0	S2=0	Mode 0
	S1 = 1	Mode 1	S2=1	Mode 1
S2 - Redundancy function	S2 = 0	OFF	S3=0	OFF
	S2 = 1	ON	S3=1	ON
S3 - Termination	S3 = 0	CH2 not terminated	-	not relevant (Termination extern)
	S3 = 1	CH2 terminated	-	not relevant (Termination extern)
S4 - Termination	S4 = 0	CH2 not terminated	-	not relevant (Termination extern)
	S4 = 1	CH2 not terminated	-	not relevant (Termination extern)
S5 - optical Power / Distance	S5 = 0	CH3 - optical Power: Standard	S6=0	CH2 - optical Power: Standard
	S5 = 1	CH3 - optical Power: High	S6=1	CH2 - optical Power: High
S6 - optical Power / Distance	S6 = 0	CH4 - optical Power: Standard	S7=0	CH3 - optical Power: Standard
	S6 = 1	CH4 - optical Power: High	S7=1	CH3 - optical Power: High
			S8=1	Compatibility ON
			S0, S1,S4 = 0	Without function
			S5 = 0	in Position 0

Table 5: Switch assignment of the OZD Profi 12M ... at S8=1 as a spare or expansion device for OZD Profi P3a, ...P4a, ...P3a-1300 and ...P4a-1300.

4.4 Setting the operating mode and transmitting power

Note:

- S1 does not have a function on OZD Profi 12M ... with only one electrical interface.
- S7 does not have a function on OZD Profi 12M ... with only one optical interface.

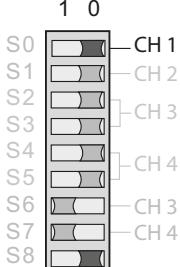
The following details only apply for the S8 default position (S8 = 0).

- The DIP switch **S0** is used to set the operating mode of the electrical port **CH1**.
- The DIP switch **S1** is used to set the operating mode of the electrical port **CH2**.
- This applies exclusively to device variants OZD Profi 12M x22:
The DIP switches **S2** and **S3** are used to set the operating mode of the optical port **CH3**.
- The DIP switches **S4** and **S5** are used to set the operating mode of the optical port **CH4**.

4.4.1 Setting the operating mode of the electrical ports (CH1, CH2)

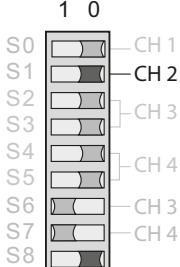
■ Operating mode: electrical ports (CH1, CH2) with segments monitoring

CH1 is activated in this operating mode if **S0** is in Position **0**.

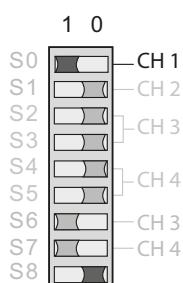


Applies to device variants with 2 electrical ports:

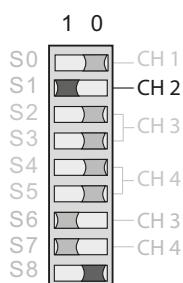
CH2 is activated in this operating mode if **S1** is in Position **0**.



■ **Operating mode: electrical ports (CH1,CH2) without segment monitoring**



CH1 is activated in this operating mode if **S0** is in Position 1. Please note that this operating mode should only be set in the star segment of the star topology.



Applies to device variants with 2 electrical ports:

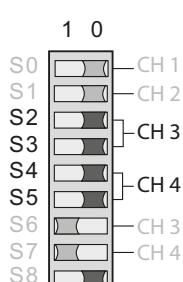
CH2 is activated in this operating mode if **S1** is in Position 1. Please note that this operating mode should only be set in the star segment of the star topology.

4.4.2 Setting the operating mode of the optical ports (CH3, CH4)

The operating mode can be set individually for each optical port.

Combinations of the operating modes “Line with optical fiber link monitoring” and “Line without optical fiber link monitoring” are also possible. Note that the operating mode of the two optical ports which are connected by the fiber line must always have the same settings. The operating mode “Redundant optical ring” must always be set at both of the optical ports.

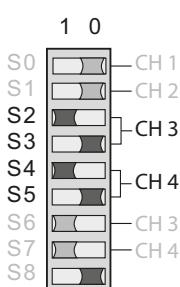
■ **Operating mode: Line with optical fiber link monitoring and segmentation**



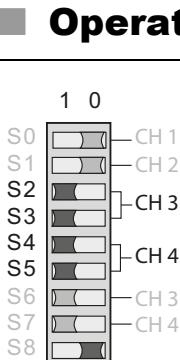
CH3 is activated in this operating mode if **S2** and **S3** are in Position 0.

CH4 is activated in this operating mode if **S4** and **S5** are in Position 0.

■ Operating mode: Line without optical fiber link monitoring



CH3 is activated in this operating mode if **S2** is in Position **1** and **S3** is in Position **0**.
CH4 is activated in this operating mode if **S4** is in Position **1** and **S5** is in Position **0**.



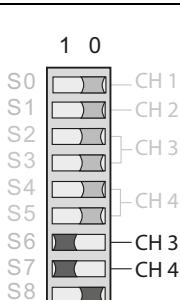
CH3 is activated in this operating mode if **S2** and **S3** are in Position **1**.
CH4 is activated in this operating mode if **S4** and **S5** are in Position **1**.

4.4.3 Reducing the optical transmitting power

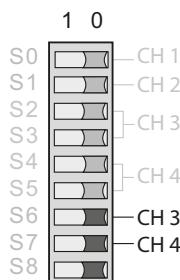
The OZD Profi 12M P1x PRO and OZD Profi 12M Gxx (EEC) have a high level of optical transmitting power. Optical overloading may result if these repeaters are connected with non-OZD Profi 12M ... devices using plastic optical fiber cables, particularly if short cable lengths are used. In this case the optical transmitting power can be reduced.

The following details only apply for the S8 default position (S8 = 0).

- The DIP switch **S6** is used to set the transmitting power of **CH3**.
- The DIP switch **S7** is used to set the transmitting power of **CH4**.



- Leave **S6** in Position **1** (default) if the optical fiber link to **CH3** functions correctly in this position.
- Leave **S7** in Position **1** (default) if the optical fiber link to **CH4** functions correctly in this position.

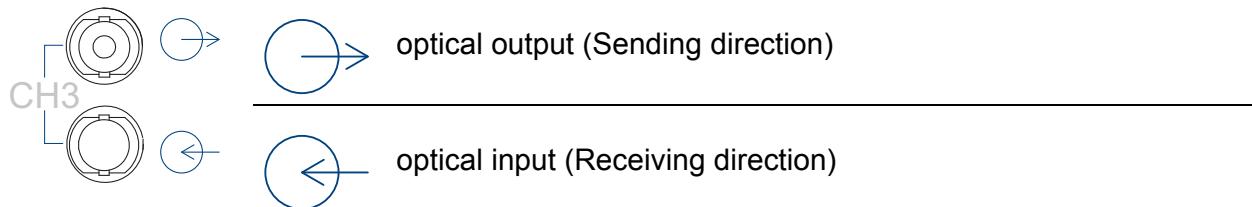


- Switch **S6** to Position **0** (reduced) if overloading is detected at non-OZD Profi device at **CH3**.
- Switch **S7** to Position **0** (reduced) if overloading is detected at a non-OZD Profi device at **CH4**.

Note:

- When using OZD Profi 12M Gxx-1300 (EEC), transmit power must be set to Default (S6/S7 in Position 1).
- When using PCF fibers, transmit power must be set to Default (S6/S7 in Position 1) for 660 nm.
- When using PCF fibers, transmit power must be set to Default (S6/S7 in Position 0) for 850 nm.
- S7 has no function on devices with only one optical port.

4.5 Connecting the optic bus cables



Proceed as follows:

- Use a duplex fiber-optic cable with BFOC/2.5 (ST ®) connectors to connect the individual repeaters.
- Pay attention to the maximum cable length of the fiber-optic cable as well as the possible types of fibers specified in the Technical Data.
- Make sure that each optical input is connected to an optical output at the opposite end (“cross-overlink”). The corresponding BFOC sockets of the two ports are marked on the lower front panel.
- Ensure sufficient strain relief for the fiber-optic cables and pay attention to their minimum bend radiiuses.
- Unused BFOC sockets are to be covered with the protective caps supplied. Incident ambient light and, in particular, great ambient brightness, can affect the network. The penetration of dust may impair operation of the optical components.

4.6 Connecting the electric bus cables

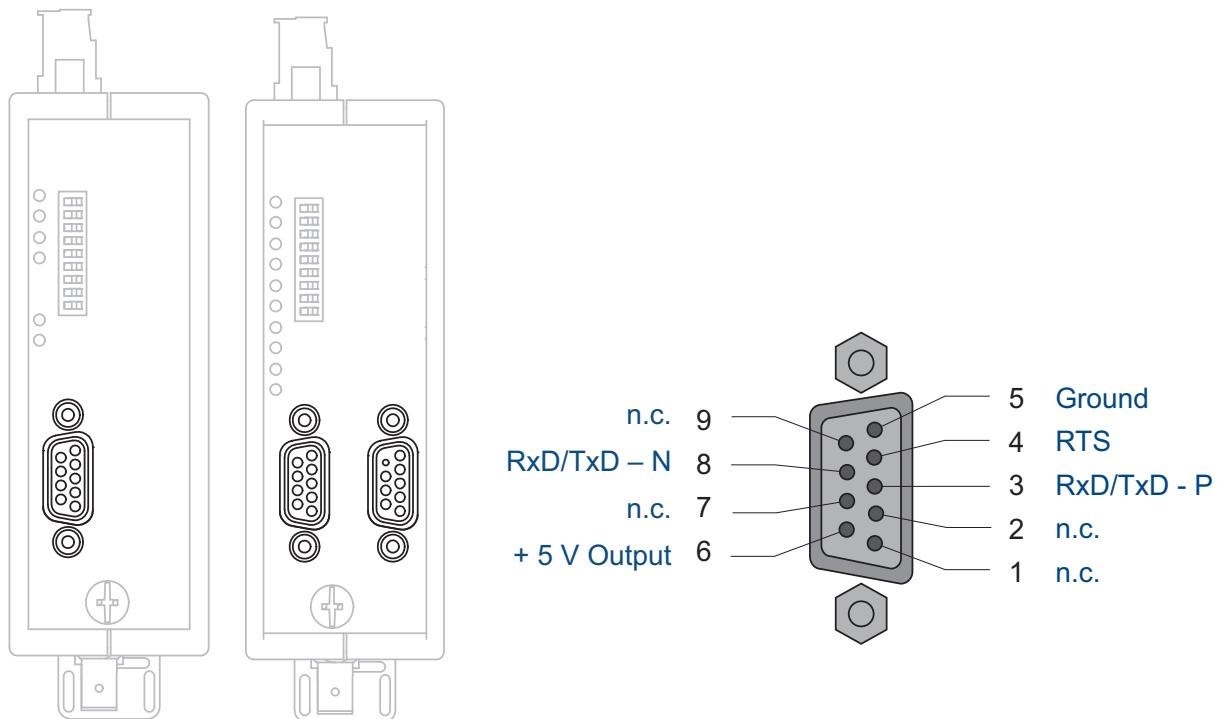


Figure 7: Assignment of D-Sub socket

- ▶ Depending on the device variant, the repeaters are fitted with one or two RS 485 electrical ports. This is a 9-pin D-Sub socket with a screw lock (inside thread UNC 4-40).
- ▶ The pin assignment complies with the PROFIBUS standard. At Pin 6 there is a short circuit-proof 5 V output for supplying external pull-up/pull-down resistors.
- ▶ As opposed to the 24V power supply, the RS 485 bus lines RxD/TxD-N and RxD/TxD-P are indirect-coupled (functional separation) within SELV restrictions.
- ▶ The RS 485 interface is electrically connected to the front panel/function ground.
- ▶ Only use shielded and twisted-pair wiring as a RS 485 bus line.
- ▶ Use a PROFIBUS bus connector plug to connect the RS 485 bus segment.

Note:

- If the repeater is at the beginning or end of a bus segment, this connector must have an activated bus terminal resistor combination.
- Ensure that the bus segment connected to the RS 485 interface is terminated at both ends.
- Only use a connecting cable which is terminated at both ends to connect a single device.
- All PROFIBUS bus connector plugs in a network must be securely screwed onto the RS 485 interfaces.
- Attaching or removing the bus connector plugs, inadequately attached bus connector plugs or loose bus wires within the plug can lead to malfunctions in the optical and electrical networks.

Proceed as follows:

- Attach or remove the RS 485 bus connector plug quickly and without twisting them.
- Remove the RS 485 bus line from the OZD Profi 12M ... if a device is not connected to the other end, or there is an OZD Profi which has been disconnected from the power supply. The open line otherwise acts as an antenna and can cause interference.
- When connecting a RS 485 bus line to the OZD Profi 12M ... in an active network, keep to the following sequence in order to avoid interference:
 - Place the RS 485 bus connector plug onto the device which is to be connected (e.g. to a programming device) and screw it on tightly.
 - Attach the RS 485 bus connector plug to the OZD Profi 12M ... quickly and without twisting the connector, and screw it on tightly. Proceed in the reverse order when removing a device from the network.

Data rate	Range per segment
12 Mbit/s	100 m
6 Mbit/s	100 m
3 Mbit/s	100 m
1.5 Mbit/s	200 m
500 kBit/s	400 m
187.5 kBit/s	1000 m
93.75 kBit/s	1200 m
45.45 kBit/s	1200 m
19.2 kBit/s	1200 m
9.6 kBit/s	1200 m

Table 6: Range of RS 485 bus segment with cable type A

Properties of cable type A:

- Characteristic impedance: 135 - 165 Ohm
- Capacity coating: $\leq 30 \text{ pF/m}$
- Loop resistance: $\leq 110 \text{ Ohm/km}$
- Wire diameter: $> 0.64 \text{ mm}$
- Wire cross section: $> 0.34 \text{ mm}^2$

4.7 **Connecting the function ground and the shield of the bus cable**



WARNING

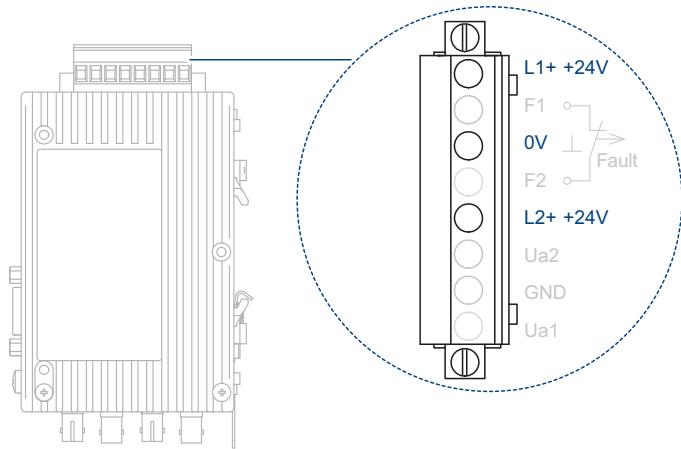
There is no contact separation between the bus lines and the connection for the function ground.

Observe the following safety instructions:

- Do not use bus lines to connect repeaters to device parts which have a different earth potential. The different voltages could destroy the repeaters.
- Avoid electrical bus lines, which are partly or entirely laid outside buildings. If lightening strikes close by, this could destroy the repeaters. Use F/O cables for bus connections outside buildings.
- The shield of the bus cable, together with the function ground connection, must be connected to an equipotential rail in the switch cabinet. The equipotential rails of the switch cabinets, which are connected to one another by means of an electrical RS 485 bus cable, must have a low-impedance connection to one another.
- The function ground of the repeater is effected by means of the connection of the screw terminal block on front of the device.

4.8 Connecting the power supply

Note: To connect the lines for the power supply, remove the 8-pin terminal block on the top of the repeater from the device.



Proceed as follows:

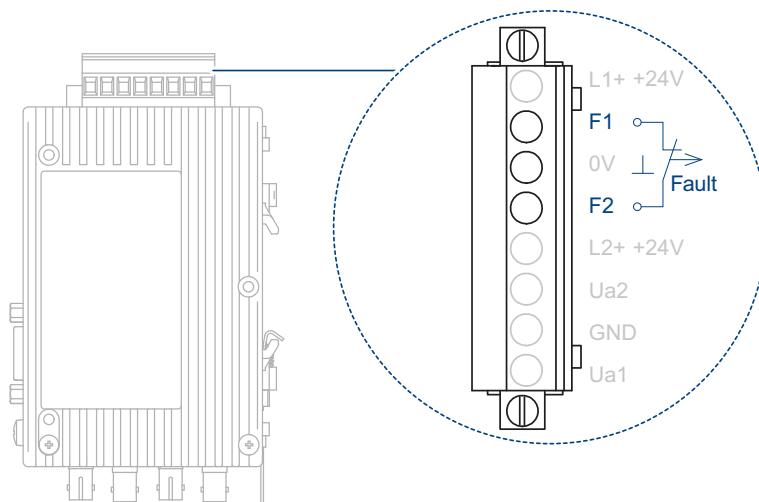
- Only supply the OZD Profi 12M ... with a stabilized safety extra-low voltage (SELV) in accordance with IEC/EN 60950-1, EN 61131-25, 24 V maximum. It is supplied via the 8-pin terminal block on the top of the repeater.
- To improve the operating safety, a redundant power supply consisting of separate sources can be used. You can input the supply voltage in two ways:
 - Terminal +24 V (L1+) of the terminal block
 - Terminal +24 V (L2+) of the terminal block
 - The minus connection for each is indicated by "0V".
- The two voltages can have any values – even different ones – within the specified limits.
- However, there is no load distribution. If necessary, the power supply unit with the higher output voltage must supply the power alone.
The supply voltage inputs are protected against incorrect pole connection.
The operating voltage is electrically isolated from the function ground connection and from the other connections.

4.9 Connecting the signal contact (optional)

Note:

- To connect the signal contact lines, remove the 8-pin screw terminal block on top of the repeater from the device.
- Use the correct pin assignment for the 8-pin terminal block.
- Make sure that the electrical insulation of the connection cables of the signal contacts is sufficient. Incorrect connections can destroy the repeater.

On the 8-pin terminal block on the top of the repeater, the unconnected pins of a relay can be used as signal contacts. When the OZD Profi 12M ... is working correctly, the contact is closed. If there is an error or a power failure, the contact is opened.



The following problems with the network and the repeater can be signalled by means of the signal contact:

Supply voltage	interrupted incorrectly connected
Internal device errors	
Received data	no input signal at port 3 (optical) (The numbering of the ports depends on device variant)
	no input signal at port 4 (optical) (The numbering of the ports depends on device variant)
	faults on port 1 (electrical) or port 2 (electrical)
Redundant optical ring	interruption of an optical fiber a repeater fails

4.10 Connecting the analog voltage outputs (optional)

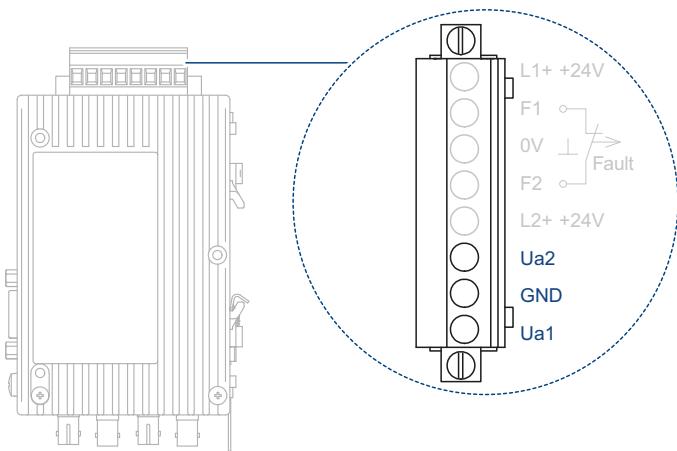


Figure 8: Analog voltage outputs – connections for 3-pin terminal block

The device has two analog voltage outputs, Ua1 and Ua2. These voltage outputs are connected using a 8-pin screw terminal on top of the repeater. The screw terminal is suitable for cable leads that have a cross section between 0.2 - 2.5 mm².

The analog voltage outputs supply a short-circuit-proof output voltage dependent on the optical power input at port 2 or port 3, for diagnosis purposes and, for example, for preventative maintenance, in the range from 0 - 5 V (each with reference to "GND" of the 8-pin terminal block). The analog voltage outputs are electrically connected to the front panel/function ground.

The measuring voltage can be determined by a standard volt meter (ungrounded, high-impedance). This allows the incoming optical power to be documented, e.g. for later measurements (aging, damage), a pass/fail examination to be performed (threshold value), wiring to be carried out on input terminals of a Profibus I/O module, thereby making the control system available. As with other process variables, it is possible to define warning thresholds there and use them for preventative maintenance.

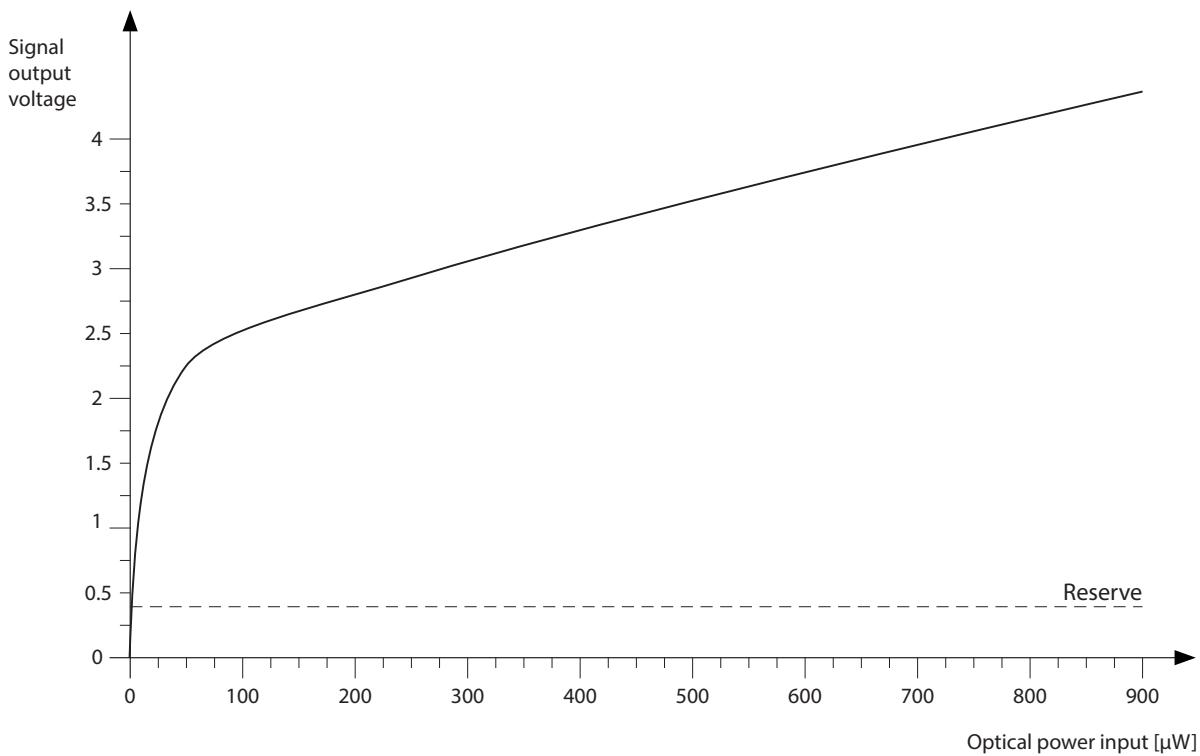


Figure 9: Correlation of measured output voltage to signal quality

Note: For a measured value to be valid, it is necessary that the partner OZD Profi 12M ... on the other end of the optical fiber transmits regular PROFIBUS telegrams. An OZD Profi 12M ... is no substitute for a calibrated, optical level meter. However, it provides each optical port with a voltage derived from the peak value of the optical PROFIBUS telegram without disrupting the communication of data. With regular bus operation, this analog voltage can be used as an indicator for an alteration in optical attenuation. Because data traffic and temperature can affect the voltage value, you should not set any warning threshold too close to the actual value.

5 Configuration

During configuration, the PROFIBUS network parameter "Slot time" must be adapted to the network coverage, network topology and the data rate due to frame delays caused by lines and network components, as well as by monitoring mechanisms in the network components.

■ Configuration of redundant optical rings

The following configuration conditions must be fulfilled in the redundant optical ring [See "Redundant ring" on page 30](#).

- (1) Configuration of a non-existent bus subscriber
- (2) Increasing the retry value to at least 3
- (3) Checking and adjusting the slot time

Use the user-specific profile of the configuration tool to set the parameters under (2) and (3).

Calculate the slot time with the following equation:

$$\text{Slot time} = a + (b \times \text{Length}_{\text{OF}}) + (c \times \text{Number}_{\text{OZD}})$$

Slot time	is the monitoring period in bit times.
Length _{OF}	is the sum of all the optical fiber lines (segment lengths) in the network.
Number _{OZD}	is the number of OZD Profi 12M ... in the network.

Data rate	a	b	c
12 Mbit/s ^a	1651	240	28
6 Mbit/s ^a	951	120	24
3 Mbit/s ^a	551	60	24
1.5 Mbit/s ^a	351	30	24
500 kBit/s	251	10	24
187.5 kBit/s	171	3.75	24
93.75 kBit/s	171	1.875	24
45.45 kBit/s	851	0.909	24
19.2 kBit/s	171	0.384	24
9.6 kBit/s	171	0.192	24

Table 7: Constants for calculating the slot time at DP standard (redundant optical ring).

- a. Use the values from [table 9](#) if the calculated slot time is smaller than the minimum slot time indicated in the table.

Data rate	a	b	c
12 Mbit/s ^a	1651	240	28
6 Mbit/s ^a	951	120	24
3 Mbit/s ^a	551	60	24
1.5 Mbit/s ^a	2011	30	24
500 kBit/s	771	10	24
187.5 kBit/s	771	3.75	24
93.75 kBit/s	451	1.875	24
45.45 kBit/s	851	0.909	24
19.2 kBit/s	181	0.384	24
9.6 kBit/s	171	0.192	24

Table 8: Constants for calculating the slot time at DP/FMS ("universal") and DP with S595U (redundant optical ring)

The calculation of the slot time only takes into consideration the optical network and the connection of bus subscribers to the OZD Profi 12M ... via an RS 485 bus segment with a respective length of max. 20 m. Longer RS 485 bus segments must be allowed for by adding them to the $Length_{OF}$.

Note: When the slot time is configured with a too small value the OZD Profi 12M ... will, through its fault function and fault indications, indicate such. The System-LED will blink red/green.

Note: Using the OZD Profi 12M G11-1300 and ... G12-1300 (EEC) at data rates of 12 MBit/s, 6 MBit/s, 3 MBit/s and 1.5 MBit/s the minimum slot times according to the following table must be met.

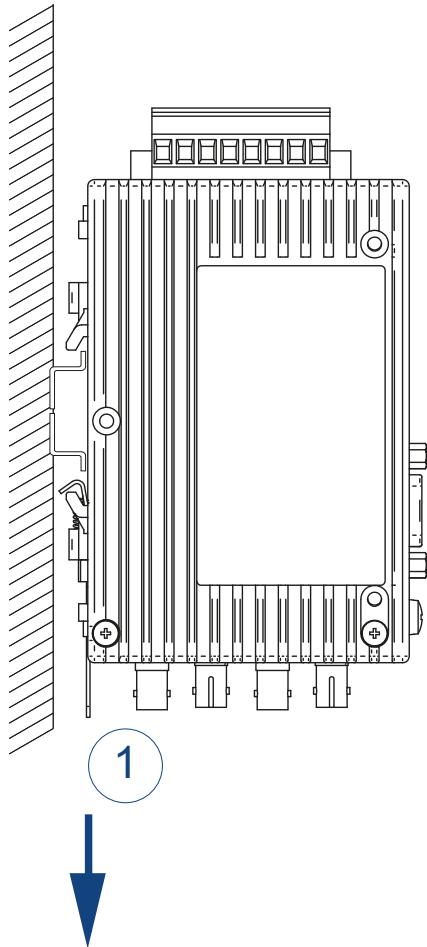
[See table 9 on page 55.](#)

Data rate	Minimum slot time
12 MBit/s	3800 t_{Bit}
6 MBit/s	2000 t_{Bit}
3 MBit/s	1000 t_{Bit}
1.5 MBit/s	530 t_{Bit}

Table 9: Minimum slot time on OZD Profi 12M G11-1300 and OZD Profi 12M G12-1300 (EEC)

6 Disassembly

To remove the device, pull down on the locking slide.



7 Technical data

■ General technical data

OZD Profi 12M ...	P11	G11	G11-1300
	P12	G12	G12-1300
		G12-EEC	G12-1300-EEC
Dimensions W × H × D	See "Dimension drawings" on page 60.		
Weight	approx. 19.75 oz (560 g)		
Supply voltage See "Requirements for connecting electrical wires" on page 6.			
Nominal voltage DC	24 V		
Voltage range DC incl. maximum tolerances	18 V ... 32 V		
Connection type	8-pin terminal block		
Power loss buffer	> 10 ms at 20.4 V DC		
Overload current protection at input	Non-replaceable fuse		
Back-up fuse for each voltage input			
Nominal rating:	2 A		
Characteristic:	slow blow		
Output voltage/current for terminal resistors (Pin 6 D- Sub socket)	5 V DC + 5%, -10%		
Peak inrush current	< 4 A		

Signal contact

[See "Requirements for connecting electrical wires" on page 6.](#)

Maximum Switching current 1 A

Maximum switching voltage 60 V DC

Maximum switching capacity max. 30 V DC, resistive load

Signal transmission

Transmission speed 9.6; 19.2; 45.45; 93.75; 187.5; 500 kBit/s 1.5; 3; 6; 12 Mbit/s

Setting transmission rate automatic

Bit error rate $<10^{-9}$

Signal processing time $\leq 6.5 t_{\text{Bit}}$
(any input/output)

Retimer

Input port 1 to 4

- Signal distortion $\pm 30\%$
- Mean bit length $\pm 0.12\%$

Output Port 1 to 4

Mean bit length $\pm 0.01\%$

Electrical port

Isolation voltage 500 V

Input/output signal RS 485 level

Climatic conditions during operation

Ambient temperature

► OZD Profi 12M ... without "EEC" feature	+32 °F ... +140 °F (0 °C ... +60 °C)	+32 °F ... +140 °F (0 °C ... +60 °C)	+32 °F ... +140 °F (0 °C ... +60 °C)
► OZD Profi 12M ... with feature "EEC" ^a		-4 °F ... +140 °F (-20 °C ... +60 °C)	-4 °F ... +140 °F (-20 °C ... +60 °C)

Humidity

5 % ... 95 %
(non-condensing)

Air pressure

minimum 700 hPa (+9842 ft; +3000 m)

Climatic conditions during storage

Ambient temperature	-40 °F ... +158 °F (-40 °C ... +70 °C)
---------------------	----------------------------------------

Humidity

5 % ... 95 %
(non-condensing)

Air pressure

minimum 700 hPa (+9842 ft; +3000 m)

Pollution degree

2

Protection classes	Laser protection	Class 1 in compliance with IEC 60825-1
	Degree of protection	IP20

a. The OZD Profi 12M G12(-1300) can also be supplied in a special design for more severe environmental conditions. This variant is designated the OZD Profi 12M G12(-1300) EEC. The DIP switches on the OZD Profi 12M G12(-1300) EEC may also only be operated at ambient temperatures between +32 °F ... +140 °F (0 °C ... +60 °C).

Optical port	P	G	G-1300
Wavelength	650 nm	860 nm	1300 nm
Launchable optical power:	-	-	-
in fiber 10/125 (default)	-	-	-19 dBm
in fiber 50/125 (default)		-17 dBm	-17 dBm
in fiber 62.5/125 (default)	-	-13 dBm	-17 dBm
in fiber 200/230/125 (default)	-17 dBm	-	-
in fiber 200/230/125 (reduced)	-	13 dBm	-
in fiber 980/1000 (default)	-5 dBm	-	-
in fiber 980/1000 (reduced)	-10 dBm	-	-
Receiver sensitivity	-25 dBm	-28 dBm	-29 dBm
Receiver overload limit	0 dBm	-1 dBm	-3 dBm

Damping values of the fiber optic	P	G	G-1300
Wavelength	650 nm	860 nm	1300 nm
Damping values:			
Fiber 10/125	-	-	0.5 dB/km
Fiber 50/125	-	3 dB/km	1 dB/km
Fiber 62.5/125	-	3.5 dB/km	1 dB/km
Fiber 200/230	10 dB/km	8 dB/km	-
Fiber 980/1000	0.225 dB/m	-	-

Transmission distance ^a	P	G	G-1300
Wavelength	650 nm	860 nm	1300 nm
System reserve	2 dB	3 dB	2 dB

Transmission distance ^a	P	G	G-1300
Transmission distance:			
Fiber 10/125		-	15000 m
Fiber 50/125 (default)	-	3000 m	10000 m
Fiber 62.5/125 (default)	-	3000 m	10000 m
Fiber 200/230/125 (default)	400 m	-	-
Fiber 200/230/125 (reduced)	-	800 m (12 MBit/s) 1000 m (<12 MBit/s)	-
Fiber 980/1000 (default)	80 m	-	-
Fiber 980/1000 (reduced)	57 m	-	-

a. The specified transmission distance must not be exceeded regardless of the maximum allowed attenuation line.

■ EMC and immunity

EMC interference emission

Radiated emission

EN 55022	Class A
EN 55032	Class A
FCC 47 CFR Part 15	Class A

EMC interference immunity

Electrostatic discharge

EN 61000-4-2 IEEE C37.90.3	Contact discharge	± 4 kV
EN 61000-4-2 IEEE C37.90.3	Air discharge	± 8 kV

Electromagnetic field

EN 61000-4-3	80 MHz ... 1000 MHz 1400 MHz ... 2000 MHz	10 V/m
--------------	----------------------------------------------	--------

Fast transients (burst)

EN 61000-4-4 IEEE C37.90.1	DC supply connection	± 2 kV
EN 61000-4-4 IEEE C37.90.1	Data line	± 1 kV

Voltage surges - data line

EN 61000-4-5	line/ground	± 1 kV
--------------	-------------	--------

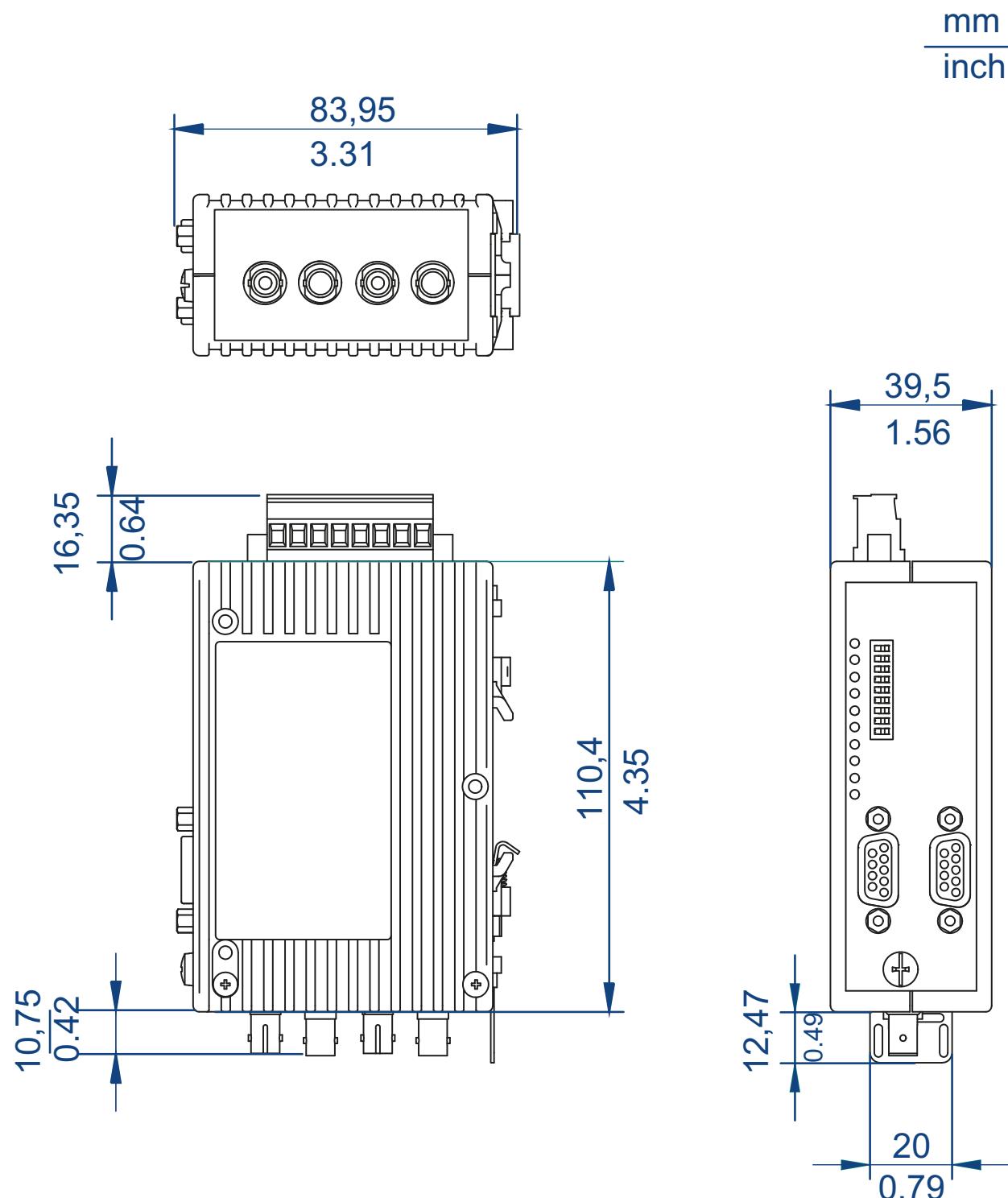
Conducted disturbances

EN 61000-4-6	150 kHz ... 80 MHz	10 V
--------------	--------------------	------

■ Power consumption/power output

Device name	Maximum power consumption	Maximum power output
OZD Profi 12M ...	3.9 W (1 electrical port) 4.7 W (2 electrical ports)	13.3 BTU (IT)/h 16 BTU (IT)/h

■ Dimension drawings



8 Scope of delivery, order numbers and accessories

■ Scope of delivery

Number	Article
1 x	Device
1 x	General safety instructions

■ Order numbers/product description

Device name	Order number
OZD Profi 12M G11	942 148-001
OZD Profi 12M G12	942 148-002
OZD Profi 12M G22	942 148-003
OZD Profi 12M G11-1300	942 148-004
OZD Profi 12M G12-1300	942 148-005
OZD Profi 12M G22-1300	942 148-006
OZD Profi 12M P11	942 148-007
OZD Profi 12M P12	942 148-008
OZD Profi 12M P22	942 148-009
OZD Profi 12M G12 EEC	942 148-102
OZD Profi 12M G12-1300 EEC	942 148-105
OZD Profi 12M G22 EEC	942 148-103
OZD Profi 12M G22-1300 EEC	942 148-106

9 Underlying technical standards

Name	
CSA C22.2 No. 142	Canadian National Standard(s) – Process Control Equipment – Industrial Products
FCC 47 CFR Part 15	Code of Federal Regulations
UL/IEC 61010-1, UL/IEC 61010-2-201	Safety for Control Equipment
EN 55022	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
EN 55032	Electromagnetic compatibility of multimedia equipment.
EN 61000-3-2	Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions
EN 61000-3-3	Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker.
EN 61000-6-2	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments
EN 61000-6-4	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
EN 61131-2	Programmable controllers – Part 2: Equipment requirements and tests

Table 10: List of the technical standards

The device has an approval based on a specific standard only if the approval indicator appears on the device casing.

The device generally fulfills the technical standards named in their current versions.

10 Help with problems

10.1 Troubleshooting

This chapter helps you to localize faults after they have been indicated (by LEDs or signal contacts).

■ Fault indicated on the system LED

For more details see chapter “[Display elements](#)” on page 20.

■ Fault indicated on CH1, CH2

- Make sure that the DIP switch S0 is in Position 1 if the OZD Profi connected to the electrical star segment of a star topology.
[See “Star topology” on page 28.](#)
- Make sure that the fault is still displayed after removal of the RS 485 connector.
Still displayed: Device is defective^c. Replace the OZD Profi.
No longer displayed: The fault lies in the RS485 bus segment.
 - Check all RS 485 connectors as described in “[Connecting the electric bus cables](#)”.
 - [See “Connecting the electric bus cables” on page 47.](#)
 - Check the structure and shielding of the RS 485 bus segment.
 - Check the RS 485 bus segment using a PROFIBUS bus monitor.
 - Check the configuration of all bus subscribers.

■ Fault indicated on CH3, CH4

- Make sure that optically only repeaters of the same type are connected together.
[See “\[Network Topologies\]\(#\)” on page 24.](#)
- Make sure that the optical ports, which are connected via optical fibers, have been set to the same operating mode.
[See “\[Setting the operating mode and transmitting power\]\(#\)” on page 43.](#)
- Make sure that the settings given in chapter “[Connecting the optic bus cables](#)” have been observed when connecting and laying the optical bus lines.
[See “\[Connecting the optic bus cables\]\(#\)” on page 46.](#)

c. This is not the case if the monomaster of a PROFIBUS network is connected to the RS 485 bus segment which is to be examined. Replace the OZD Profi concerned with another OZD Profi from the network, and then carry out the test described above.
If the OZD Profi still malfunctions when connected elsewhere, the device is defective. Replace the OZD Profi.
If the OZD Profi does not malfunction elsewhere, the fault lies in the RS 485 bus segment. Carry out the measures described above.

10.2 Systematic troubleshooting

This chapter helps you to localize an error systematically with the help of the following questions.

See also the description of the LED displays. [See “Display elements” on page 20.](#)

Check the following points:

- ▶ Are all the electrical bus lines terminated at both ends in accordance with PROFIBUS specification (even for short electrical lines)?
- ▶ Are the lengths of the optical cables within the threshold values specified in this manual?
[See “Technical data” on page 57.](#)
- ▶ Is the reception level of the optical ports within the permissible range?
- ▶ Are the DIP switches set according to the topology, mode of operation, compatibility and optical transmission power?
[See “Setting the operating mode and transmitting power” on page 43.](#)
[See “Setting compatibility” on page 40.](#)

Were the following points taken into account regarding topology:

Line topology

- ▶ Line topology selected and set according to the specifications in chapter “Line topology” with or without F/O link monitoring.
[See “Line topology” on page 25.](#)

Star topology

- ▶ CH1 must be switched to “Monitor off” mode ($S0=1$) for all OZD Profi 12M ... connected to the electrical star segment.
- ▶ Wiring of the electrical star segment must be undertaken with care.
- ▶ Expansion of the electrical star segment is to be as small as possible.
- ▶ The electrical star segment must be terminated at both ends.
- ▶ No bus subscribers are to be connected to the electrical star segment.
- ▶ Non-busy optical ports are to be switched to “Line without F/O link monitoring” operating mode.

Redundant optical ring

- ▶ Both ports of all the OZD Profi 12M ... must be set to “Redundant optical ring” operating mode.
- ▶ All the OZD Profi 12M ... within a ring must be optically linked with one another.

Note: Configuration (these settings can usually be set on the PROFIBUS master using configuration software, not on the OZD Profi 12M ...):

- Slot time configured correctly? (for basics, see chapter “Redundant ring” for calculation, see “TSLOT.exe”)
- Retry value configured correctly? (target value ≥ 3 , see chapter “Redundant ring”).
- Value of MIN T_{SDR} configured correctly? (target value ≥ 11 , see chapter Retry).
- In case of redundant optical ring only: “HSA” (Highest Station Address) configured correctly or “a non-existent bus subscriber” configured?

Note: Check the status of the LEDs and use chapter “Display elements” and “Troubleshooting” to check the possible causes and resolve the errors detected.

10.3 Problem reporting

If the transmission in the RS 485 network is still not satisfactory after all the points in chapter “Display elements” and “Troubleshooting” have been clarified, then please contact our support with answers to the following questions:

- ▶ Exact type designation of the OZD Profi 12M For identification purposes, please provide the order number printed on the device (18 digits).
- ▶ What data rate is being used?
- ▶ How are the DIP switches set on all the devices?
- ▶ Send us a detailed network plan with the fiber type and fiber length, the location and length of the electrical segments and the position of the terminators.
- ▶ Give as detailed a description of the error as possible in your own words.
- ▶ Which values were configured for slot time, retry value and MIN T_{SDR} ?
- ▶ What is the status of the LEDs on the relevant OZD Profi 12M ... ?
- ▶ Please provide the voltage values of the analog voltage outputs for the relevant OZD Profi 12M
See “[Connecting the analog voltage outputs \(optional\)](#)” on page 52.
- ▶ In case of redundant optical ring only: Which value was configured for HSA (Highest Station Address)? Was a non-existent bus subscriber configured?

Note: If you do not provide complete answers to the questions, we cannot process your query.

A Further support

Technical questions

For technical questions, please contact any Hirschmann dealer in your area or Hirschmann directly.

You find the addresses of our partners on the Internet at
<http://www.hirschmann.com>.

A list of local telephone numbers and email addresses for technical support directly from Hirschmann is available at
<https://hirschmann-support.belden.eu.com>.

This site also includes a free of charge knowledge base and a software download section.

Hirschmann Competence Center

The Hirschmann Competence Center is ahead of its competitors on three counts with its complete range of innovative services:

- ▶ Consulting incorporates comprehensive technical advice, from system evaluation through network planning to project planning.
- ▶ Training offers you an introduction to the basics, product briefing and user training with certification.
You find the training courses on technology and products currently available at <http://www.hicomcenter.com>.
- ▶ Support ranges from the first installation through the standby service to maintenance concepts.

With the Hirschmann Competence Center, you decided against making any compromises. Our client-customized package leaves you free to choose the service components you want to use.

Internet:

<http://www.hicomcenter.com>



HIRSCHMANN

A **BELDEN** BRAND