User Manual

Installation
Fiberoptic Repeater
OZD Modbus Plus...
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 11

1 Description 12
  1.1 General description 12
     1.1.1 Modnet, Modbus and Modbus Plus 16
  1.2 Device view 17
  1.3 Display elements 18

2 Network Topologies 19
  2.1 Redundant optical ring
     (HIPER ring) 19
  2.2 Line topology without redundancy 22

3 Installation guidelines 23
  3.1 Electromagnetic compatibility (EMC) 23
  3.2 Interference suppression of switched inductances
     3.2.1 Suppressing switched inductances with fuses 23
     3.2.2 Cabinet lighting 23
  3.3 Arrangement of devices and cables
     3.3.1 Reducing interference by providing adequate space:
     3.3.2 Standard recommendations for the arrangement of
            devices and cables 24
     3.3.3 Using bus line shields 24
     3.3.4 Shield connections 25

4 Installation 26
  4.1 Checking the package contents 26
  4.2 Installing and grounding the device
     4.2.1 Installing the device onto the DIN rail 27
     4.2.2 Mounting the device on a mounting plate 28
     4.2.3 Grounding the device 28
  4.3 Connecting the optic bus cables 29
  4.4 Connecting the electric bus cables 30
4.5 Connecting the power supply 31
4.6 Connecting the signal contact 32
4.7 Setting the optical transmitting power 33
4.8 Connecting the analog voltage outputs (optional) 33

5 Disassembly 35

6 Technical data 36

7 Scope of delivery, order numbers and accessories 40

8 Underlying technical standards 41

A Further support 42
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 36.
- 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

Requirements for connecting the signal contact
- Before connecting the signal contact, always verify that the requirements listed are complied with.

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 36.

Table 2: Requirements for connecting the signal contact
### Requirements for connecting the supply voltage

Before connecting the supply voltage, **always** verify that the requirements listed are complied with.

#### 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 supply cables are suitable for ambient air temperatures of at least 167 °F (75 °C). The power supply cable 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:

<table>
<thead>
<tr>
<th>Alternative 1</th>
<th>The power supply complies with the requirements for a limited power source (LPS) as per EN 60950-1.</th>
</tr>
</thead>
</table>
| Alternative 2 | Relevant for North America:
  - The power supply complies with the requirements according to NEC Class 2. |
| Alternative 3 | All of the following requirements are complied with:
  - 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 36. |

---

**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)

2011/65/EU (RoHS)

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 36

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

1.1 General description

The OZD Modbus Plus... is designed for use in optical Modbus Plus bus field bus networks. It allows conversions of electrical Genius bus interfaces into optical Modbus Plus bus interfaces and vice versa.

You have the option to integrate the OZD Modbus Plus... into existing electrical Modbus Plus field bus networks. OZD Modbus Plus... repeaters can also be used to configure a complete Modbus Plus bus field bus network with the line or ring topology.

No adjustment is necessary during start-up.

- **Device casing**
  The device is supplied in a metal housing. You have the option of mounting the device onto the DIN rail or to the mounting plate.

- **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 Modbus Plus... functions at a transmission rate of 1 MBit/s.

- **Redundancy**
  Redundant optical signal transmission ensures a very high level of transmission reliability. The redundant operating power supply can further improve the operating reliability.
**Port**

The repeater has 3 mutually independent ports (channels), each of which consists of a transmitter and receiver. The electrical port is a 4-pin connector, 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. 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.

![Power supply diagram](image)

**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.

![Signal contact diagram](image)
Measuring output
One measuring output is available for each optical port. The measuring output is connected to the 8-pin screw type terminal block.

Signal regeneration
The OZD Modbus Plus... regenerates the signal form and amplitude of the received data. This function allows unlimited cascading of optical links.
1.1.1 Modnet, Modbus and Modbus Plus

- **Modnet**
  With Modnet a complete communication system for automation engineering was offered by the former AEG. This is not a single bus system but a communication system with 3 performance classes. Due to the different requirements, these performance classes range from usage in proximity to the process, to superordinate backbone communication.

<table>
<thead>
<tr>
<th>Performance class 1:</th>
<th>Modnet1/M+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication in proximity to object</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Performance class 2:</th>
<th>Modnet1/P, Modnet1/IS, Modnet1/SFB</th>
</tr>
</thead>
<tbody>
<tr>
<td>System communication</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Performance class 3:</th>
<th>Modnet3/MMSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backbone communication</td>
<td></td>
</tr>
</tbody>
</table>

The following applies:

<table>
<thead>
<tr>
<th>Modnet1/M+</th>
<th>Low-cost, Modbus Plus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modnet1/P</td>
<td>System field bus in accordance with Profibus standard</td>
</tr>
<tr>
<td>Modnet1/IS</td>
<td>System and sensor-actuator bus in accordance with Interbus standard</td>
</tr>
<tr>
<td>Modnet3/MMSE</td>
<td>Communication system for superordinate levels in accordance with IEEE 802.3 and MAP (MMS on Ethernet)</td>
</tr>
</tbody>
</table>

- **Modbus**
  Modbus is a widely used, defined message structure for master-slave communication. A Modbus message, sent from the master to the slave, contains the address of the slave, the command, the data, and an error checksum. Modbus RTU and Modbus ASCII are different data codes. As only the data format is defined, any medium can be used (RS232, RS422, RS485 copper cable, optical fiber, radio, …). Suitable optical fiber converters are OZDV 24…, OZDV 114… and OZDV 485… .

- **Modbus Plus**
  Modbus Plus is a complete protocol and network definition. Modbus Plus uses the Modbus command structure, but it transmits the commands together with a token that is passed rapidly from one network user to the next. Modbus Plus defines how the token is forwarded, how commands are repeated, how the data is checked for errors, and how these errors are then indicated, and of course the complete design of the physical interface, this also relates to the data cable and the network infrastructure (tabs, bridges, terminating resistors, …). The objective here is a real "plug and play“ field bus system.
1.2 Device view

Front view using example of device variants OZD Modbus Plus... / OZD Modbus Plus G12-1300

1  8-pin terminal block for power supply, signal contact, measuring output
1a Pin assignment of the signal contact
1b Pin assignment of the power supply
1c Pin assignment of the measuring output
   Ua1 for the optical port CH2
   Ua2 for the optical port CH3
2  8-pin DIP switch
3  CH1 - electrical port
1.3 Display elements

<table>
<thead>
<tr>
<th>Display</th>
<th>Color</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>System</td>
<td>none</td>
<td>Supply voltage is too low</td>
</tr>
<tr>
<td></td>
<td>green</td>
<td>Data reception at all ports</td>
</tr>
<tr>
<td></td>
<td>red</td>
<td>No data reception for 500 ms at minimum one port</td>
</tr>
<tr>
<td>Ports</td>
<td>none</td>
<td>No data reception for 500 ms</td>
</tr>
<tr>
<td></td>
<td>green</td>
<td>Data reception; no error detected</td>
</tr>
<tr>
<td></td>
<td>orange/yellow</td>
<td>Data reception, error detected:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- echo error (fiber in sending direction interrupted)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- malformed data packets (Jabber or Fragment)</td>
</tr>
<tr>
<td>Signal contact</td>
<td>open</td>
<td>- Supply voltage is too low</td>
</tr>
<tr>
<td></td>
<td>closed</td>
<td>Data reception at all ports</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- No data reception for 500 ms at minimum one port</td>
</tr>
</tbody>
</table>
2 Network Topologies

2.1 Redundant optical ring (HIPER ring)

This network topology is used in the case of an optical link between end devices or bus segments. The implementation of a redundant link with OZD Modbus Plus... repeaters ensures a high degree of reliability.

As many repeaters as required can be operated in a HIPER ring. For the safe and reliable operation of the ring redundancy, it is necessary that at least one active terminal unit is connected to the electrical port (CH 1) of each OZD Modbus Plus... repeater.

The failure of an optical cable between any two OZD Modbus Plus... repeaters does not affect the availability of the network. The repeaters detect total failure of an optical link. The port LED of the faulty link is deactivated and the failure is indicated by illumination of the red system LED and response of the signal contact.

It is advisable to install the duplex F/O cables of the two optical ports along different routes.
If problems are encountered with the configuration of a redundant optical ring on account of excessively long fiber-optic line sections, connections can also be implemented as shown in Figure 1. In this case, each repeater is linked (in spatial terms) with the next repeater but one. Two adjacent repeaters must be interconnected at the start and end of every such line. This prevents the individual fiber-optic line sections from being "excessively long".

Figure 1: Network structure in a redundant optical ring topology
**Figure 2:** Alternative wiring system for network structure in redundant optical ring topology
2.2 Line topology without redundancy

This network topology is used in the case of an optical link between end devices or bus segments.

As many repeaters as required can be operated in an optical line. For the safe and reliable operation of the ring redundancy, it is necessary that at least one active terminal unit is connected to the electrical port (CH 1) of each OZD Modbus Plus... repeater.

The first and last repeater in the line should be terminated with an "optical short-circuit". To do this, each input and output of the free ports is connected via a short length of optical cable with BFOC connectors.
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

![Interference suppression of fluorescent lamps in cabinet](image)

**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 Figure 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 Modbus Plus... 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 an OZD Modbus Plus.... The power supply wires (24 V DC and m/0 V) for the OZD Modbus Plus... must not be laid in the same cable duct as cables for load circuits. The wires (24 V DC and m/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 PROFIBUS 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.
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
- Installing and grounding the device
- Connecting the optic bus cables
- Connecting the electric bus cables
- Connecting the power supply
- Connecting the signal contact
- Setting the optical transmitting power
- 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 40.
☐ Check the individual parts for transport damage.
4.2 Installing and grounding the device

You have the following options for mounting your device:

- Installing the device onto the DIN rail
- Mounting the device on a mounting plate

Prerequisites:

- Install the device in a location where the climatic threshold values specified in the technical data are adhered to.
- 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.
- If possible, the repeaters should only be installed on a mounting plate or DIN rail with low-impedance and low-inductance grounding.
- If the mounted DIN rail and mounting plate are insulated, the repeater must be provided with a low-impedance and low-inductance ground connection directly via the grounding screw.

4.2.1 Installing the device onto the DIN rail

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.
4.2.2 Mounting the device on a mounting plate

**Note:** The repeater has 3 through-holes. The through-holes allow to mount the repeater to any flat surface, e.g. to the mounting plate of a switch cabinet.

**Proceed as follows:**
- Make 3 holes in the mounting plate corresponding the drilling template.
- Use the machine bolts (e.g. M3 x 40) to secure the repeater.
- Ensure reliable electrical connection between the repeater casing and the mounting plate.
- Place toothed washers under the bolt heads to pierce the varnish.

### 4.2.3 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.
4.3  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 radiuses.

☐ 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.
4.4 Connecting the electric bus cables

![Diagram of D-Sub socket pin assignment](image)

**Figure 5: Pin assignment of D-Sub socket**

**WARNING**
The shielding of the Sub-D connector is made of metal to ensure safe ground current conduction and must therefore be conductively connected to the shielding plate of the connector attached to the cable.

**WARNING**
Do not use Modbus Plus bus lines to connect Modbus Plus repeaters to system components to which a different ground potential is being applied. Voltage differences > 500 V could destroy the repeaters or cause the system to malfunction.

**WARNING**
Modbus Plus bus lines which are completely or partially installed outdoors should not be connected. Any lightning strikes in the immediate vicinity could otherwise destroy the repeaters. Optical cables should be used for bus connections which are routed out of buildings.
Proceed as follows:

- Only use approved shielded twisted pair cable for OZD Modbus Plus... bus wiring, e.g., Modicom "Super Cable", FT4, FT6.
- The electrical Modbus Plus interface (CH 1) is a 9-pin Sub-D connector (female). The pin assignment complies with the Modbus Plus Standard.
- A line which is fitted with 9-pin Sub-D connectors (male) should be used to connect an end device. Max. length 100 m.
- The electrical port is internally not terminated. The external termination must be provided in or on the connector of the bus line in accordance with the Modbus Plus Standard.
- The bus connection plug should be secured using screws.

4.5 Connecting the power supply

- The OZD Modbus Plus... should only be supplied with a regulated safety extra-low voltage of between 18 V and 32 V as defined in IEC 60950 / EN 60950 / VDE 0805.
- To improve the operating safety, a redundant power supply consisting of separate sources can be used. The supply voltages can be supplied in 2 ways:
  - via terminal 18 V ... 32 V of the terminal block
  - via terminal 18 V ... 32 V of the terminal block
- The common negative connection in the middle of the terminal block is indicated by (0 V).
- The two voltages can have any values, even different ones, within the specified limits.
4.6 Connecting the signal contact

Note:
- To connect the signal contact lines, remove the 8-pin 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 Modbus Plus... 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 signaled by means of the signal contact:

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>No supply voltage (with redundant supply voltage: loss of all supply voltages)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal device errors</td>
<td></td>
</tr>
<tr>
<td>Received data</td>
<td>Loss of received data at port 2 and/or port 3 (e.g. cable breakage)</td>
</tr>
<tr>
<td></td>
<td>No data received at all ports</td>
</tr>
</tbody>
</table>
4.7 Setting the optical transmitting power

Note:
- S0, S1, S3, S4, S5 and S8 do not have function on OZD Modbus Plus....
- The DIP switch S6 is used to set the transmit power of CH3.
- The DIP switch S7 is used to set the transmit power of CH4.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>S0</td>
<td>n.c.</td>
</tr>
<tr>
<td>S1</td>
<td>n.c.</td>
</tr>
<tr>
<td>S2</td>
<td>n.c.</td>
</tr>
<tr>
<td>S3</td>
<td>n.c.</td>
</tr>
<tr>
<td>S4</td>
<td>n.c.</td>
</tr>
<tr>
<td>S5</td>
<td>n.c.</td>
</tr>
<tr>
<td>S6</td>
<td>CH3</td>
</tr>
<tr>
<td>S7</td>
<td>CH4</td>
</tr>
</tbody>
</table>

- Verify that the dip switch S6 and S7 is set to position 1.

4.8 Connecting the analog voltage outputs (optional)

![Pin assignment of the analog voltage outputs](image)

Figure 6: Pin assignment of the analog voltage outputs

The device has 2 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.

![Signal output voltage vs. Optical power input](image)

**Figure 7: Correlation of measured output voltage to signal quality**

**Note:** For a measured value to be valid, it is necessary that the partner OZD Modbus Plus... on the other end of the optical fiber transmits regular Modbus telegrams. An OZD Modbus Plus... 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  **Disassembly**

To remove the device, pull down on the locking slide.
## 6 Technical data

### General technical data

<table>
<thead>
<tr>
<th>Device variant</th>
<th>OZD Modbus Plus... OZD Modbus Plus G12-1300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>See &quot;Dimension drawings&quot; on page 39.</td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 19.75 oz (560 g)</td>
</tr>
</tbody>
</table>

#### Supply voltage

<table>
<thead>
<tr>
<th>Nominal voltage DC</th>
<th>24 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage range DC incl. maximum tolerances</td>
<td>18 V ... 32 V</td>
</tr>
<tr>
<td>Connection type</td>
<td>8-pin terminal block</td>
</tr>
<tr>
<td>Power loss buffer</td>
<td>&gt; 10 ms at 20.4 V DC</td>
</tr>
<tr>
<td>Overload current protection at input</td>
<td>Non-replaceable fuse</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Back-up fuse for each voltage input Nominal rating:</th>
<th>2 A Characteristic:</th>
<th>slow blow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak inrush current</td>
<td>&lt; 4 A</td>
<td></td>
</tr>
</tbody>
</table>

#### Signal transmission

<table>
<thead>
<tr>
<th>Transmission speed</th>
<th>1 MBit/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cascadability</td>
<td>any</td>
</tr>
<tr>
<td>Signal processing time (any input/output)</td>
<td>&lt; 1 µs</td>
</tr>
</tbody>
</table>

#### Electrical port

<table>
<thead>
<tr>
<th>Input/output signal</th>
<th>Modbus Plus level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of a Modbus Plus cable</td>
<td>100 m, 328 ft</td>
</tr>
<tr>
<td>Connection options</td>
<td>max. 31 terminal data devices</td>
</tr>
<tr>
<td>Electrical isolation</td>
<td>non-replaceable fuse</td>
</tr>
<tr>
<td>terminating resistor</td>
<td>Must be attached outside to connector</td>
</tr>
</tbody>
</table>

#### Signal contact

<table>
<thead>
<tr>
<th>switching current</th>
<th>max. 1 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching voltage</td>
<td>max. 30 V DC, resistive load</td>
</tr>
</tbody>
</table>

#### Climatic conditions during operation

<table>
<thead>
<tr>
<th>Ambient temperature</th>
<th>+32 °F ... +140 °F (0 °C ... +60 °C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity</td>
<td>5 % ... 95 % (non-condensing)</td>
</tr>
<tr>
<td>Air pressure</td>
<td>minimum 700 hPa (+9842 ft; +3000 m)</td>
</tr>
</tbody>
</table>

#### Climatic conditions during storage

<table>
<thead>
<tr>
<th>Ambient temperature</th>
<th>−40 °F ... +158 °F (−40 °C ... +70 °C)</th>
</tr>
</thead>
</table>
### 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: IP40

<table>
<thead>
<tr>
<th>Optical port</th>
<th>P</th>
<th>G</th>
<th>G-1300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wavelength</td>
<td>650 nm</td>
<td>860 nm</td>
<td>1300 nm</td>
</tr>
<tr>
<td>Launchable optical power</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>into fiber 10/125 (default)</td>
<td>-</td>
<td>-</td>
<td>-19 dBm</td>
</tr>
<tr>
<td>into fiber 50/125 (default)</td>
<td>-</td>
<td>-17 dBm</td>
<td>-17 dBm</td>
</tr>
<tr>
<td>into fiber 62.5/125 (default)</td>
<td>-</td>
<td>-13 dBm</td>
<td>-17 dBm</td>
</tr>
<tr>
<td>Receiver sensitivity</td>
<td>-25 dBm</td>
<td>-28 dBm</td>
<td>-29 dBm</td>
</tr>
<tr>
<td>Receiver overload limit</td>
<td>0 dBm</td>
<td>-1 dBm</td>
<td>-3 dBm</td>
</tr>
</tbody>
</table>

### Damping values of the fiber optic

<table>
<thead>
<tr>
<th>Wavelength</th>
<th>P</th>
<th>G</th>
<th>G-1300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wavelength</td>
<td>650 nm</td>
<td>860 nm</td>
<td>1300 nm</td>
</tr>
<tr>
<td>Damping values:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fiber 10/125</td>
<td>-</td>
<td>-</td>
<td>0.5 dB/km</td>
</tr>
<tr>
<td>Fiber 50/125</td>
<td>-</td>
<td>3 dB/km</td>
<td>1 dB/km</td>
</tr>
<tr>
<td>Fiber 62.5/125</td>
<td>-</td>
<td>3.5 dB/km</td>
<td>1 dB/km</td>
</tr>
<tr>
<td>Fiber 200/230</td>
<td>10 dB/km</td>
<td>8 dB/km</td>
<td>-</td>
</tr>
<tr>
<td>Fiber 980/1000</td>
<td>0.225 dB/m</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### Transmission distance

<table>
<thead>
<tr>
<th>Wavelength</th>
<th>G</th>
<th>G-1300</th>
</tr>
</thead>
<tbody>
<tr>
<td>System reserve</td>
<td>3 dB</td>
<td>2 dB</td>
</tr>
<tr>
<td>Transmission distance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fiber 10/125</td>
<td>-</td>
<td>8000 m</td>
</tr>
<tr>
<td>Fiber 50/125 (default)</td>
<td>2700 m</td>
<td>8000 m</td>
</tr>
<tr>
<td>Fiber 62.5/125 (default)</td>
<td>3100 m</td>
<td>10000 m</td>
</tr>
</tbody>
</table>

*a. The specified distance allowed between two OZD Modbus G12-1300 must not be exceeded regardless of the optical power budget.*
## EMC and immunity

### EMC interference emission

**Radiated emission**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 55032</td>
<td>Class A</td>
</tr>
<tr>
<td>FCC 47 CFR Part 15</td>
<td>Class A</td>
</tr>
</tbody>
</table>

### EMC interference immunity

**Electrostatic discharge**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Discharge Type</th>
<th>Voltage (kV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 61000-4-2</td>
<td>Contact</td>
<td>± 4</td>
</tr>
<tr>
<td>IEEE C37.90.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EN 61000-4-2</td>
<td>Air</td>
<td>± 8</td>
</tr>
<tr>
<td>IEEE C37.90.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Electromagnetic field**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Frequency Range</th>
<th>Magnetic Field (V/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 61000-4-3</td>
<td>80 MHz ... 1000 MHz</td>
<td>10</td>
</tr>
</tbody>
</table>

**Fast transients (burst)**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Discharge Type</th>
<th>Voltage (kV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 61000-4-4</td>
<td>DC supply connection</td>
<td>± 2</td>
</tr>
<tr>
<td>IEEE C37.90.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EN 61000-4-4</td>
<td>Data line</td>
<td>± 1</td>
</tr>
<tr>
<td>IEEE C37.90.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Voltage surges - data line**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Discharge Type</th>
<th>Voltage (kV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 61000-4-5</td>
<td>line/ground</td>
<td>± 1</td>
</tr>
</tbody>
</table>

**Conducted disturbances**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Frequency Range</th>
<th>Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 61000-4-6</td>
<td>150 kHz ... 80 MHz</td>
<td>10</td>
</tr>
</tbody>
</table>

## Power consumption/power output

<table>
<thead>
<tr>
<th>Device name</th>
<th>Maximum power consumption</th>
<th>Maximum power output</th>
</tr>
</thead>
<tbody>
<tr>
<td>OZD Modbus Plus...</td>
<td>4.8 W</td>
<td>16.3 Btu (IT)/h</td>
</tr>
</tbody>
</table>
Dimension drawings

*mm*

*inch*

- Dimension drawings
  - 83,95 mm
  - 3.31 inch
  - 16,35 mm
  - 0.64 inch
  - 10,75 mm
  - 0.42 inch
  - 39,5 mm
  - 1.56 inch
  - 110,4 mm
  - 4.35 inch
  - 12,47 mm
  - 0.49 inch
  - 10,75 mm
  - 0.42 inch
7 Scope of delivery, order numbers and accessories

Scope of delivery

<table>
<thead>
<tr>
<th>Number</th>
<th>Article</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ×</td>
<td>Device</td>
</tr>
<tr>
<td>1 ×</td>
<td>General safety instructions</td>
</tr>
</tbody>
</table>

Order numbers/product description

<table>
<thead>
<tr>
<th>Device name</th>
<th>Order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>OZD Modbus Plus G12</td>
<td>942 148-010</td>
</tr>
<tr>
<td>OZD Modbus Plus G12-1300</td>
<td>942 148-011</td>
</tr>
</tbody>
</table>
# Underlying technical standards

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-Tick Declaration</td>
<td>Australian Radiocommunication Act 1998</td>
</tr>
<tr>
<td></td>
<td>Australian Radiocommunication Standard 2008</td>
</tr>
<tr>
<td>CSA C22.2 No. 142</td>
<td>Canadian National Standard(s) – Process Control Equipment – Industrial Products</td>
</tr>
<tr>
<td>DNVGL-CG-0339</td>
<td>Environmental test specification for electrical, electronic and programmable equipment and systems.</td>
</tr>
<tr>
<td>UL/IEC 61010-1, UL/IEC 61010-2-201</td>
<td>Safety for Control Equipment</td>
</tr>
<tr>
<td>EN 55032</td>
<td>Electromagnetic compatibility of multimedia equipment – Emission Requirements</td>
</tr>
<tr>
<td>EN 61000-3-2</td>
<td>Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions</td>
</tr>
<tr>
<td>EN 61000-3-3</td>
<td>Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker.</td>
</tr>
<tr>
<td>EN 61000-6-2</td>
<td>Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments</td>
</tr>
<tr>
<td>EN 61000-6-4</td>
<td>Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments</td>
</tr>
<tr>
<td>EN 61131-2</td>
<td>Programmable controllers – Part 2: Equipment requirements and tests</td>
</tr>
</tbody>
</table>

*Table 4: 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.
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