Optical Data Transmission System ODT2

Operating Manual

Table of Contents

1 General Information

1.1 Explanation of Symbols

The symbols used in this operating manual are explained below.

Attention !

This symbol appears in front of text which must be carefully observed.
Failure to heed this information can lead to injuries to personnel or damage to the equipment.

Notice

This symbol indicates text which contains important information.

☞ This symbol refers you to other chapters or other literature.

➜ This symbol indicates operations which are to be carried out.

Italics Important terms and keywords which help you locate information quickly appear to the left of the text column.

1.2 Important Terms

FSK modulation Modulation using Frequency Shift Keying.

FSK frequencies Frequencies at which data is transmitted between ODT2 optical data transceivers.

Full duplex operation Simultaneous transmission and reception of data.

Half-duplex operation Data is alternately transmitted and received only.

Bar graph A series of LEDs on the control panel used to display the receiving level when making fine adjustments.

INTERBUS Bus system according to DIN 19258.

Profibus Bus system according to DIN 19245.

Jitter Fluctuations of the significant instances of a transmitted digital signal.

Transparent transmission The data are not changed during transmission. The ODT2 simulates a copper wire connection.

1.3 Declaration of Conformity

The data transmission system ODT2 has been developed and manufactured in accordance with the applicable European standards and directives.

Notice

The corresponding declaration of conformity can be requested from the manufacturer.

The manufacturer of the product, Leuze electronic GmbH + Co. in D-73277 Owen/Teck, possesses a certified quality assurance system in accordance with ISO 9001.

2 Safety Notices

2.1 Safety Standard

The optical data transmission system ODT2 has been developed, produced and tested subject to the applicable safety standards. It corresponds to the state of the art.

2.2 Intended Use

Attention !

The protection of personnel and the device cannot be guaranteed if the device is operated in a manner not corresponding to its intended use.

Optical data transmissison systems of the type ODT2 are conceived for the optical transmission of data in the infrared light range.

In particular, unauthorised uses include:

- operation in areas where interruption of the data transmission, e.g. by covering the transmission or receiving optic, can lead to equipment damage or injury to personnel
- operation in rooms with explosive atmospheres
- operation for medical purposes

Fields of application

The optical data transmisison system ODT2 is conceived particularly for the following fields of application:

- transmission of data using the Profibus and INTERBUS field bus protocols
- use in automated high-bay warehouses
- anywhere where data transmission to and from fixed or moving objects and over large distances (up to 200 m) is required

2.3 Working Safely

Attention

Entering or making changes to the device, except where expressly described in this operating manual, is not authorized.

2.4 Organisational Measures

Documentation All entries in this operating manual must be heeded, in particular those in the section "Safety Notices".

Carefully store this operating manual where it is accessible at all times.

Safety regulations Observe the locally applicable legal regulations and the rules of the employer’s liability insurance association.

Qualified personnel Mounting, commissioning and maintenance of the device may only be carried out by qualified personnel.

Electrical work must be carried out by a certified electrician.

Repair Repairs must only be carried out by the manufacturer or an authorized representative.

3 Description

3.1 The Optical Data Transmission System ODT2

The optical data transmission system ODT2 is a contactless transmission system operating on the basis of an infrared data transceiver.Various interface modules facilitate the fitting of Profibus and INTERBUS systems to the devices. Point-to-point transmission as well as bus terminal operation are possible in INTERBUS protocol.

3.2 Characteristics of the ODT2

Performance features

- transmission rate to 2 Mbit/s
- range of 200 m with sufficient performance reserve
- profibus and INTERBUS system transmission
- full functionality of an INTERBUS bus terminal
- control signals for switching off transmission and reception
- signal outputs for error and warning messages

Advantages

- patented alignment system for fast and easy adjustment of the data transmission path
- integrated heater for use in cold temperatures to -35 °C
- simple operation with foil-type keyboard and bar-graph display
- narrow, parallel operation of several data paths possible by means of built-in apertures in front of the optics (on request)
- data transmission path can be tested with an internal test sequence without bus connection
- the large opening angle allows interruption-free transmission over transport paths with tolerance problems
- profibus transmission: error-treatment routing for fast resumption of bus communication in event of light beam interruption
- INTERBUS transmission: the integrated bus terminal reduces costs, simplifies wiring and facilitates fast bus diagnosis

3.3 Signal Inputs and Outputs

Inputs

Switch-off signals for transmitter and receiver

The ODT2 is equipped with a signal input for switching off the transmitter (’TXD’, Transmitter Disable) and a signal input for switching off the receiver (’RXD’, Receiver Disable).
The transmitters or receivers are switched on when the voltage at the input is less than 2 Volts or the input is not wired.
The transmitters or receivers are switched off when the voltage at the input is in the range of the supply voltage.

Outputs

Output signals for warnings and alarms

The ODT2 is equipped with a signal output for warning of faulty data transmission performance reserve and a signal output for an alarm in the event of transmission interruption. The output signals have the following meanings:

- voltage at output < 2 Volts - warning / alarm inactive
- voltage at output > (U_B - 2 V) - warning / alarm active

3.4 Construction

Device construction ODT2

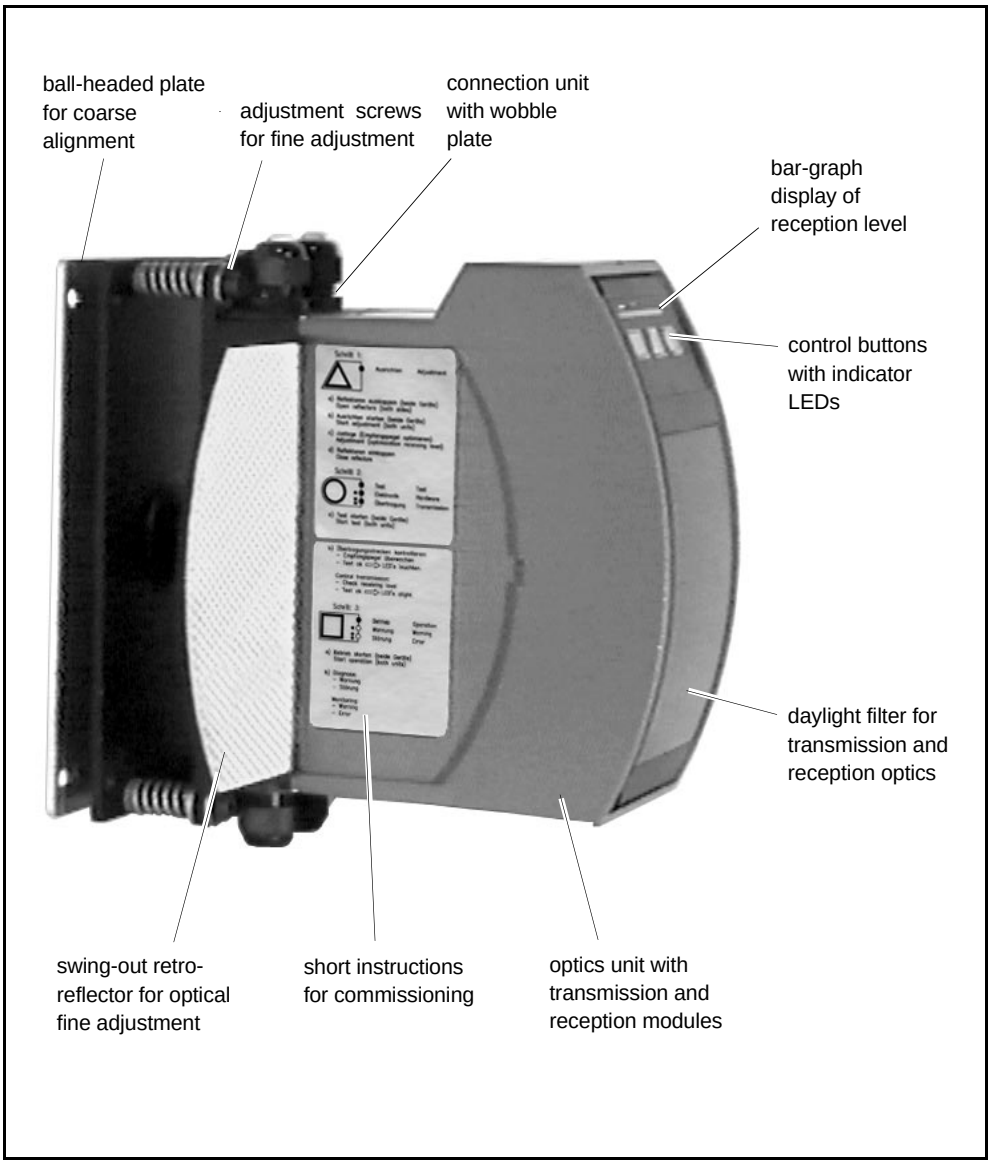

Fig. 3.4: Optical data transmission system ODT2

ODT2 device versions

The ODT2 is available in the following versions:

- with interface module for Profibus
- with interface module for INTERBUS, point-to-point connection
- with interface module for INTERBUS, operation as bus terminal
- with or without optics heating
- with various opening angles (on request)

3.5 Function

Transmitting / Receiving

The transmitter converts the electrical signals into optical signals using an infrared transmitter diode. The receiver converts the optical signals back into electrical signals using a photodiode.

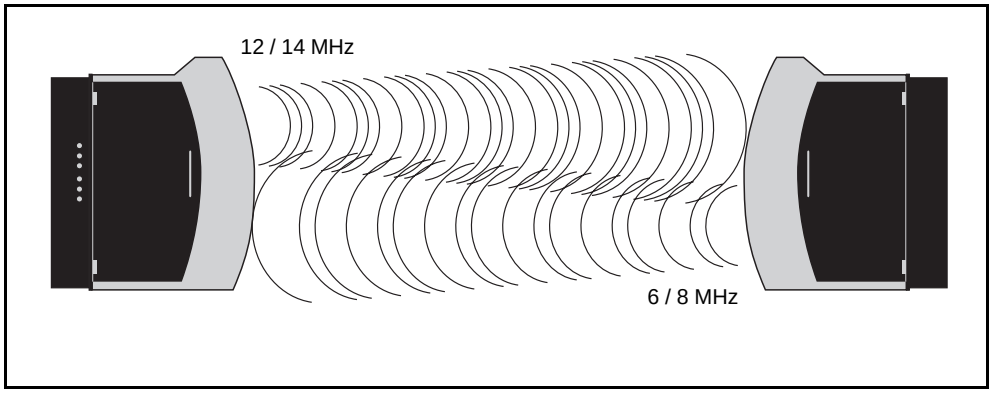

Fig. 3.5.1: Transmission and reception principle

FSK modulation

The optical transmission of the signals takes place by means of frequency shifting (FSK modulation). Information is bit-encoded in two frequencies. The receiver filters the frequencies from the received signal and converts them back into a bit sequence. As a result, interfering signals are cut out in a manner similar to light flashes from fluorescent tubes.

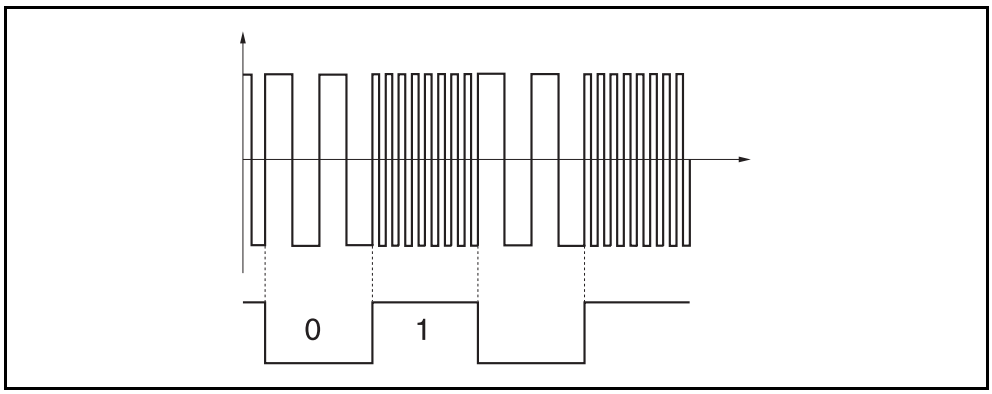

Fig. 3.5.2: FSK modulation

Frequency pairs

To prevent devices which are operating in full-duplex operation from affecting one another, each transmission direction has its own frequency pair. A complete transmission path comprises the two frequency pairs 6 / 8 MHz and 12 / 14 MHz (device versions ODT 200.1 and ODT 200.2).

3.6 Application Examples

Range of operation

The optical data transmission path ODT2 can be operated wherever more complicated, less reliable and more expensive transmission systems are used.

Optical data transmission paths replace, for example,

- looped circuits
- trailing cables
- radio links

In mobile systems, travel speed and acceleration have no influence on the transmission quality of the data. When using optical data transmission systems, one differentiates between

- coupling to bus systems by means of interface modules in slave version
- point-to-point connections as transparent connection between two control units

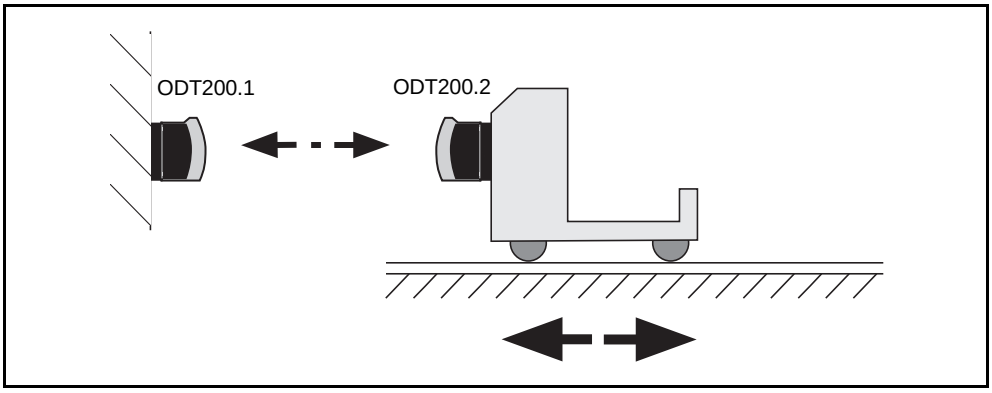

Fig. 3.6.1: Control of transport vehicles (principle)

When arranging a series of several transmission paths, be certain to alternate the transmission frequencies in order to prevent the systems from influencing one another and causing errors.

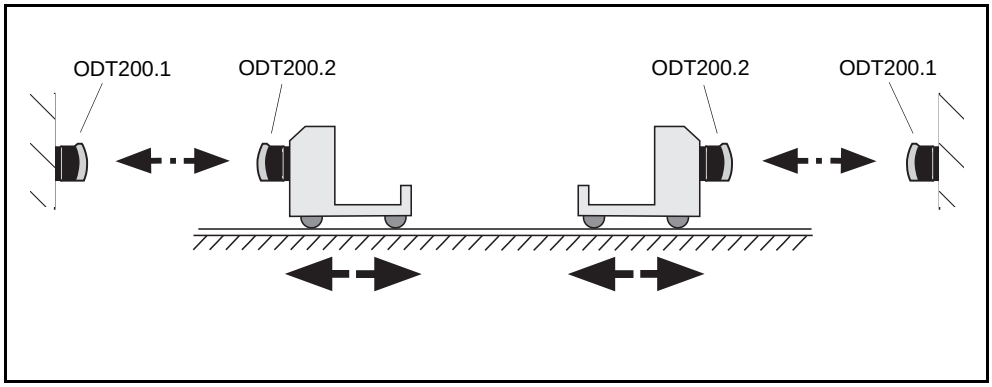

Fig. 3.6.2: Two adjacent-operating transport vehicles

3.6.1 The ODT2 in High-Bay Warehouses

High-bay warehouses are a classic application for optical data transmission paths. One optical data transceiver is used for the connection of the rack control unit to the local bus system per storage aisle.

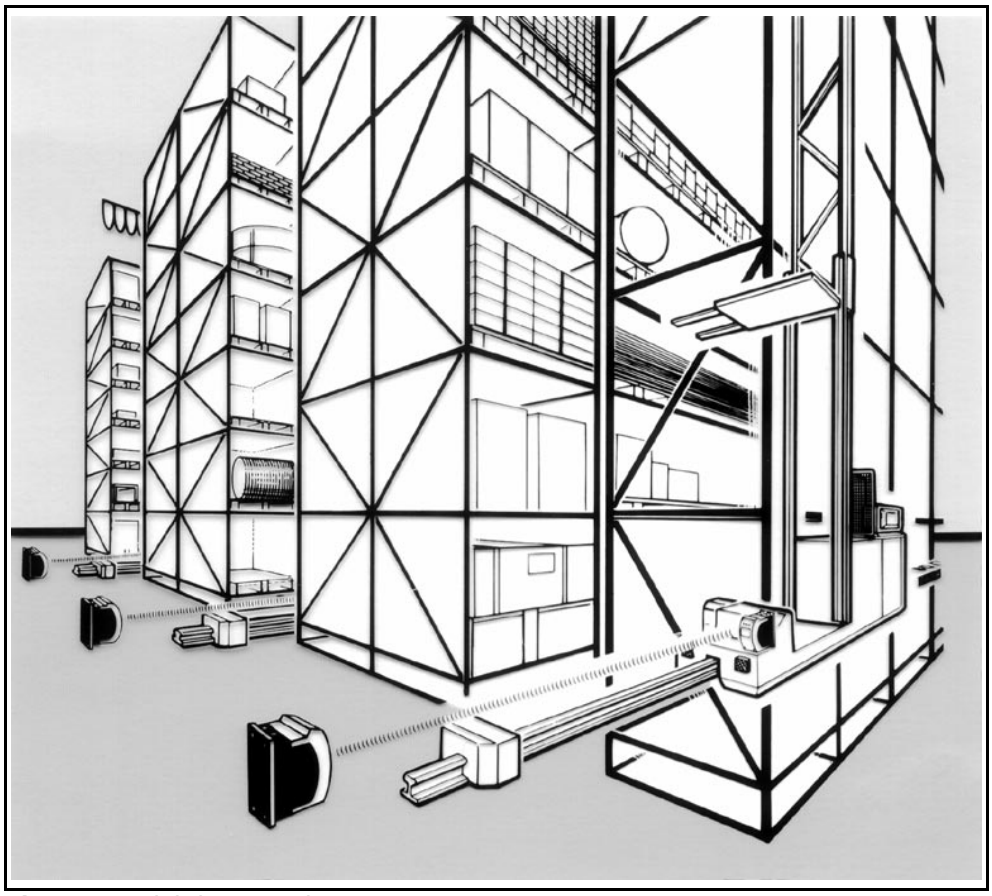

Fig. 3.6.3: High-bay warehouse

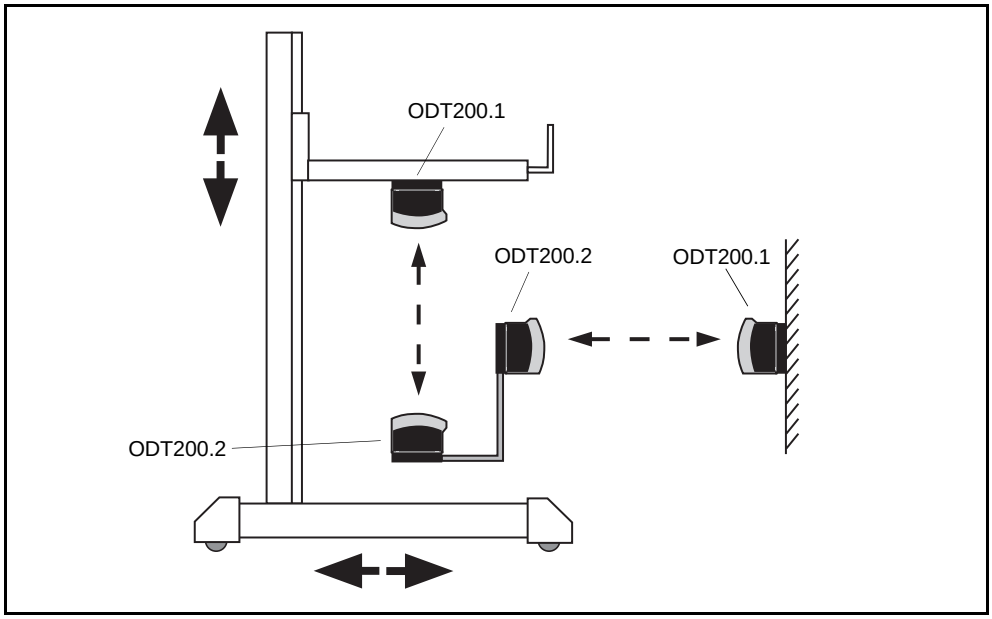

Fig. 3.6.4: Arrangement with two movable axes

3.6.2 Profibus Transmission with the ODT2

The following Profibus protocols can be transmitted:

- FMS field message specification (according to DIN 19245 parts 1, 2)
- DP decentral periphery (according to DIN 19245 part 3)
- FMS / DP combined operation (according to DIN 19245)

The transmission rate is adjustable: 9.6 ; 19.2; 93.75; 187.5; 375; 500 kbit/s and 1.5 Mbit/s. All masters or slaves which satisfy the Profibus standard can be connected. Separate Pg-cable glands for two data lines make feeding through the bus line as simple as using a stub cable with external bus terminal. The ODT 2 does not have its own system address. Transmission takes place transparently, "like a replacement for cables".

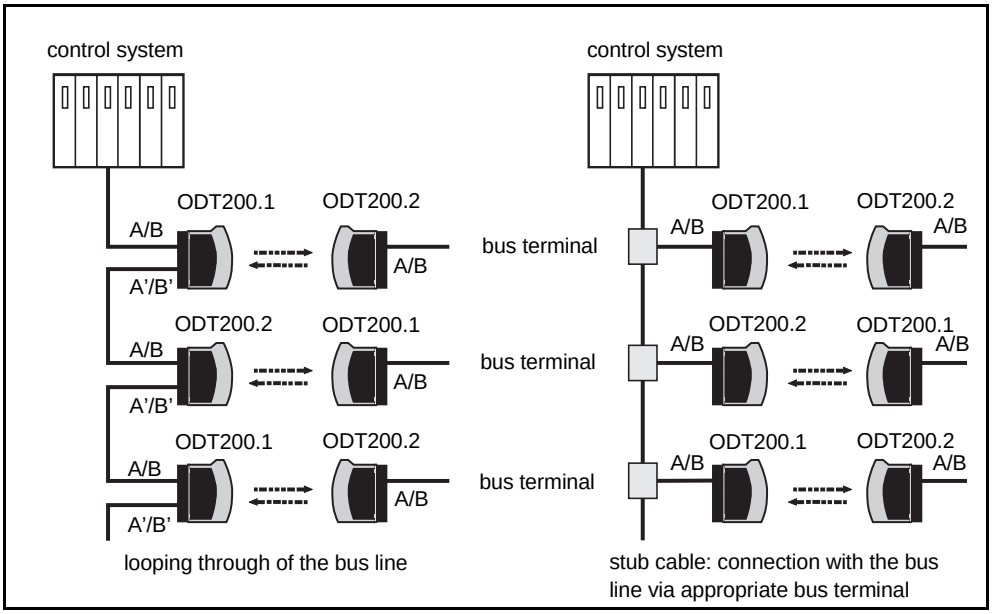

Fig. 3.6.5: Connection variations for the Profibus

3.6.3 INTERBUS Transmission with the ODT2, Point-to-Point Connection

All masters or slaves satisfying the INTERBUS standard can be connected. As a result, the ODT2 takes on the function of a purely transparent transmission medium.

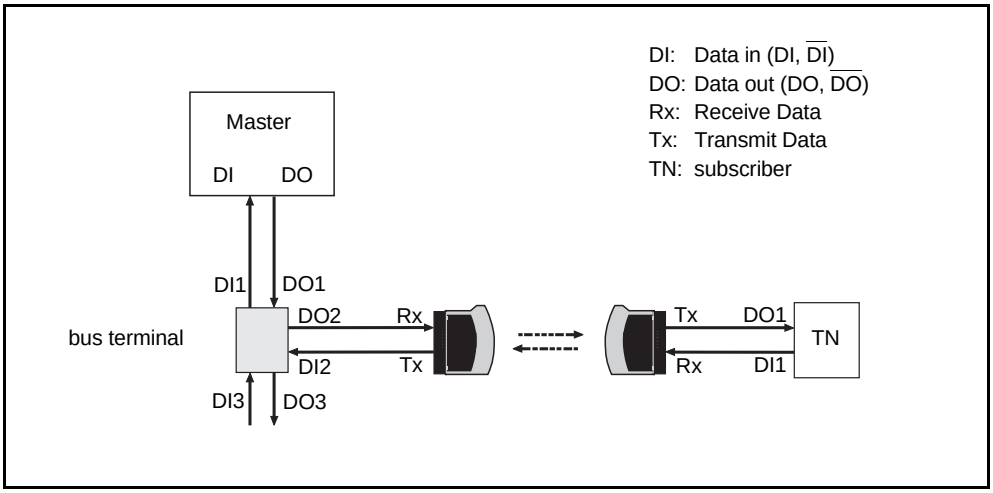

Fig. 3.6.6: INTERBUS point-to-point connection with external bus terminal

3.6.4 INTERBUS-Transmission, ODT2 as Bus Terminal

In the version ODT2 with integrated INTERBUS bus terminal, the optical data transceiver is integrated as a subscriber in the INTERBUS system.

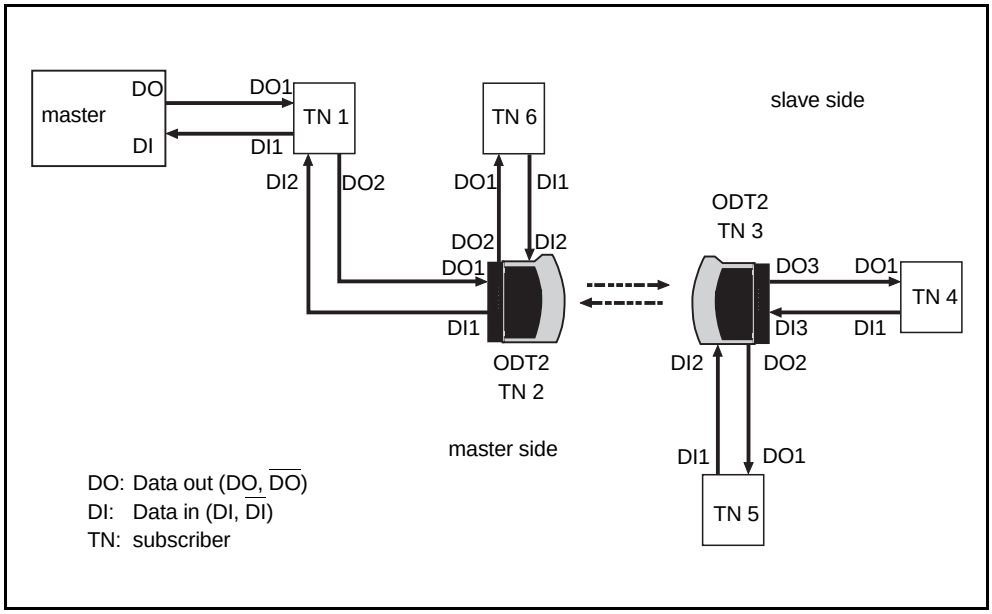

Fig. 3.6.7: ODT2 as bus terminal

4 Specifications

4.1 General Specifications

Manufacturer:	Leuze electronic GmbH + Co., In der Braike 1, D-73277 Owen / Teck
Model:	ODT2, optical data transmission system
General data	
Housing	diecast aluminium
Daylight filter	Makrolon
Dimensions	232 x 115 x 235 mm (H x W x D)
Weight	approx. 3 kg
Protection class	IP 65
Power supply	
Operating voltage without optics heating	10 ... 30 V DC
Operating voltage with optics heating	20 ... 30 V DC
Current consumption without optics heating	approx. 300 mA at 24 V DC
Current consumption with optics heating	approx. 1.3 A at 24 V DC
Optics	
Transmission medium	Infrared light, wavelength 880 nm
Opening angle	± 1.5° to optical axis ± 0.75° to optical axis (on request) ± 0.4° to optical axis (on request)
Optics	glass optics behind daylight filter
Control and display elements	
Foil-type keyboard on front	buttons for alignment operation, test operation and normal operation with integrated indicator LEDs 20-character bar-graph display for fine adjustment and receiving level control
Connection unit	six LEDs for displaying the set transmission rate in the Profibus or for diagnosis and service display in the INTERBUS
Interfaces	
Profibus	FMS / DP / combined operation FMS/DP
INTERBUS	point-to-point connection by means of RS 422 or INTERBUS subscriber interface with integrated bus terminal
Inputs	
Transmitter deactivation TXD	operating voltage: transmitter inactive; 0 V: transmitter active
Receiver deactivation RXD	operating voltage: rcvr. inactive; 0 V: rcvr. active

Outputs

Warning signal	data transmission without performance reserve operating voltage: active; 0 V: inactive
Error	no data transmission possible operating voltage: active; 0 V: inactive
Output load	max. 200 mA
Protective circuit	surge current, surge voltage, transients

Environmental conditions

Operating temperature range	without optics heating - 10 ... + 50°C with optics heating - 35 ... + 50 °C
Storage temperature range	- 30 ... + 50 °C
Humidity	max. 90 % rel. humidity, no condensation
Vibration	tested in accordance with IEC 68.2.6
Shock	tested in accordance with IEC 68.2.27
EMC	tested in accordance with IEC 801

4.2 Dimensioned drawing

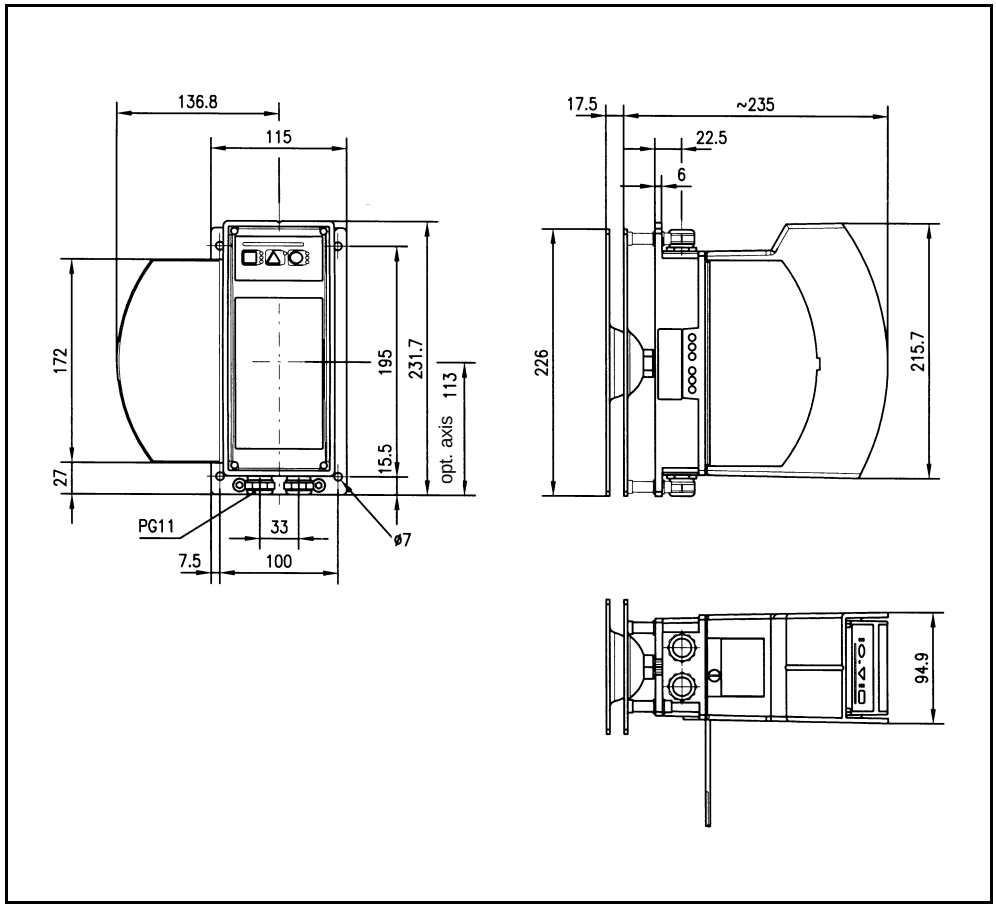

Fig. 4.1: Dimensioned drawing ODT2

4.3 Profibus Data Transmission

Protocol	Profibus in accordance with DIN 19245 parts 1, 2 and 3, Sinec L2-FMS, Sinec L2-DP
Transmission rates	9.6 kbit/s; 19.2 kbit/s; 93.75 kbit/s; 187.5 kbit/s; 375 kbit/s; 500 kbit/s; 1.5 Mbit/s adjustable by means of DIP switches

☞ Application example Chap. 3.6.2; connection Chap. 6.3.1

4.4 INTERBUS Data Transmission

Point-to-point connection

Interface	RS 422 in accordance with DIN 66348 T1
Transmission rates	
RS 422	continuously adjustable to 2 Mbit/s
INTERBUS	500 kbit/s

☞ Application example Chap. 3.6.3; connection Chap. 6.3.2

ODT2 as INTERBUS bus terminal

Interface	Interbus in accordance with DIN 19258
Transmission rate	500 kbit/s

☞ Application example Chap. 3.6.4; connection Chap. 6.3.3

5 Accessories / Order Designations

Addresses for ordering

Products available from Leuze electronic GmbH + Co. can be ordered from all of the sales and service addresses listed on the reverse of the envelope.

Optical Data Transmission System ODT2,
Order Designation

Break down of the order designation

The order designation for the ODT2 is structured according to the following scheme:

ODT2/200. A-BCDE

The letters A to E represent the following device variants:

- A FSK frequencies
  .1 = carrier frequency pair 1
  .2 = carrier frequency pair 2
- B Interface
  0 = no interface
  1 = Profibus
  2 = RS 422 (INTERBUS point-to-point)
  3 = INTERBUS bus terminal
- C Opening angle
  0 = without optics unit
  1 = ± 1.5°
  2 = ± 0.75° (on request)
  3 = ± 0.4° (on request)
- D Connection unit
  0 = without connection unit
  1 = Profibus connection unit
  2 = RS 422 connection unit
  3 = INTERBUS connection unit
- E Optics heating
  0 = without optics unit
  1 = without optics heating
  2 = with optics heating

Notice:

The ODT2 is offered mainly as a complete unit. This means that the order designations denote complete units, and delivery includes connection unit, interface module and optics unit.

Two complete devices with different FSK frequencies (.1 and .2) must be ordered for each transmission path.

In addition, we offer the three components: connection unit, interface module and optics unit individually for service and spare parts needs.

Order designations

Complete devices

ODT2/200.1-1111 ODT2/200.2-1111	200 m range, Profibus RS 485, 1.5° opening angle, without optics heating
ODT2/200.1-2121 ODT2/200.2-2121	200 m range, INTERBUS RS 422 1.5° opening angle, without optics heating
ODT2/200.1-3131 ODT2/200.2-3131	200 m range, INTERBUS bus terminal 1.5° opening angle, without optics heating
ODT2/200.1-1112 ODT2/200.2-1112	200 m range, Profibus RS 485 1.5° opening angle, with optics heating
ODT2/200.1-2122 ODT2/200.2-2122	200 m range, INTERBUS RS 422 1.5° opening angle, with optics heating
ODT2/200.1-3132 ODT2/200.2-3132	200 m range, INTERBUS bus terminal 1.5° opening angle, with optics heating

opening angles 0.75° and 0.4° on request

☞ Fig. 6.1, Device name plate

5.1 Individual Components

The following components can also be order individually for service and spare part needs:

Connection units

AT2-0010	Profibus connection unit
AT2-0020	RS 422 connection unit (INTERBUS point-to-point)
AT2-0030	INTERBUS bus terminal connection unit

Interface modules

IM2-1000	Profibus interface module
IM2-2000	RS 422 interface module (INTERBUS point-to-point)
IM2-3000	Interface module for INTERBUS

Optics units

OA2/200.1-0101	Optics unit 6 / 8 MHz without heater
OA2/200.2-0101	Optics unit 12 / 14 MHz without heater
OA2/200.1-0102	Optics unit 6 / 8 MHz with heater
OA2/200.2-0102	Optics unit 12 / 14 MHz with heater

A complete unit can be assembled from connection unit, interface module and optics unit.

5.2 Mounting Accessories

Ball-headed plate

A ball-headed plate is available on request for trouble-free, coarse alignment and mounting of the ODT2 under difficult conditions.

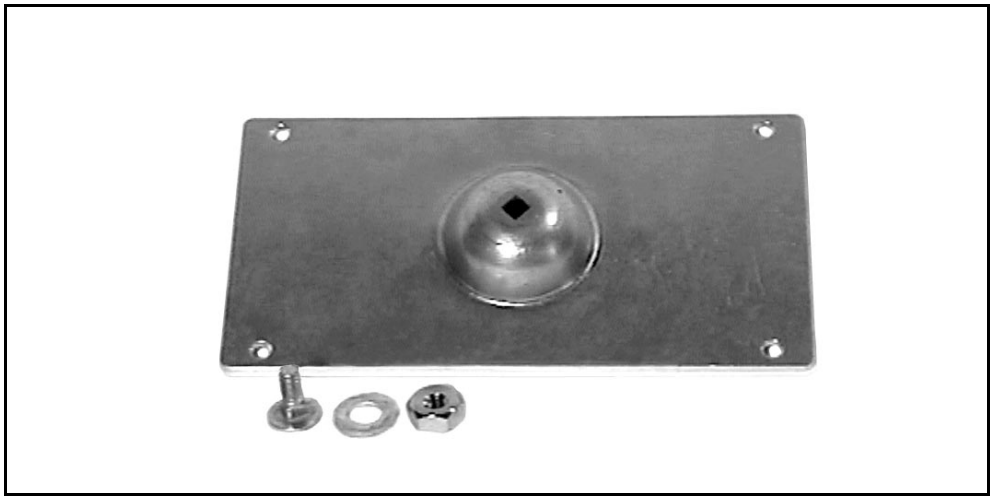

Fig. 5.2: Ball-headed plate

5.3 Laser Alignment Aid

A laser alignment aid for the ODT2 can be ordered on request.

5.4 Recommended Cable

Profibus

Special connection cables for the installation of the ODT2 supply and control lines are not necessary. The Profibus standard specifies two cable types for the connection of the data lines into the FMS and DP systems.

Cable type A is particularly suited for high transmission rates and long ranges. For transmission rates above 500 kbit/s, cable type A must be used. Cable type B should be used only with short ranges and low transmission rates.

	Cable type A	Cable type B
Characteristic impedance	135...165 Ω (at 3...20 MHz)	130...135 Ω (at f > 100 kHz)
Cable capacitance	< 30 pF / m	type < 30 pF / m
Wire cross section	min. 0.34 mm^2	min. 0.22 mm^2
Cable type	twisted pairs, 1x2; 2x2; or 1x4 conductor	twisted pairs, 1x2; 2x2; or 1x4 conductor
Resistance	< 110 Ω / km	< 110 Ω / km
Signal loss	max. 9 dB over entire line length	max. 9 dB over entire line length
Shielding	copper-mesh shielding or mesh shielding and foil shielding	copper-mesh shielding or mesh shielding and foil shielding

INTERBUS

Cables with the following specifications are recommended for use in the INTERBUS system:

Designation	LI-YCY ...
Type	4-conductor, twisted pair
Wire cross section	0.14 mm^2
Resistance	< 140 Ω / km
Insulation resistance of the wires	min. 200 MΩ / km
Mutual capacitance	max. 120 nF / km
Test volt. wire / wire	1200 V
Test volt. wire / shielding	1200 V
Shielding	copper-mesh shielding or mesh shielding and foil shielding

6 Installation

6.1 Storage, Transportation

Attention

When transporting, package the device so that it is protected against collision and humidity. Optimal protection is achieved when using the original packaging. Heed the required environmental conditions specified in the technical data.

Unpacking

➜ Check the packaging for any damage. If damage is found, notify the post office or shipping agent as well as the supplier.

➜ Check the delivery contents using your order and the delivery papers:

- delivered quantity
- device type and model as indicated on the name-plate
- accessories
- operating manual(s)

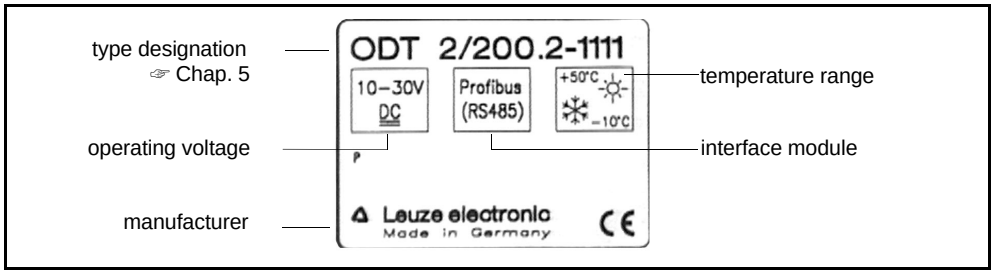

Fig. 6.1: ODT2 device name plate

➜ Save the original packaging in case the device must be stored or shipped at a later time.

Should you have questions, please contact your distributor or the responsible Leuze electronic sales office (see reverse of this operating manual).

➜ Observe the locally applicable regulations when disposing of the packaging materials.

Cleaning

➜ Before installing, clean the ODT2 optics with a soft cloth. Remove all packaging remains, e.g. carton fibres or Styrofoam balls.

Attention

Do not use an aggressive cleaning material such as thinner or acetone to clean the device.

6.2 Mounting

6.2.1 Securing

Accessories

A ball-headed plate is available as an alignment aid for securing the ODT2:

☞ Chapter 5: Accessories / Order Designations

Mounting the ODT2

Methods of securing:

- directly on the wobble plate; hole grid 195 x 100 mm, max. M6
- with aid of the ball-headed plate; hole grid 195 x 100 mm, max. M6

The ball-headed plate, available as an accessory, allows securing on inclined braces, columns or similar structures.

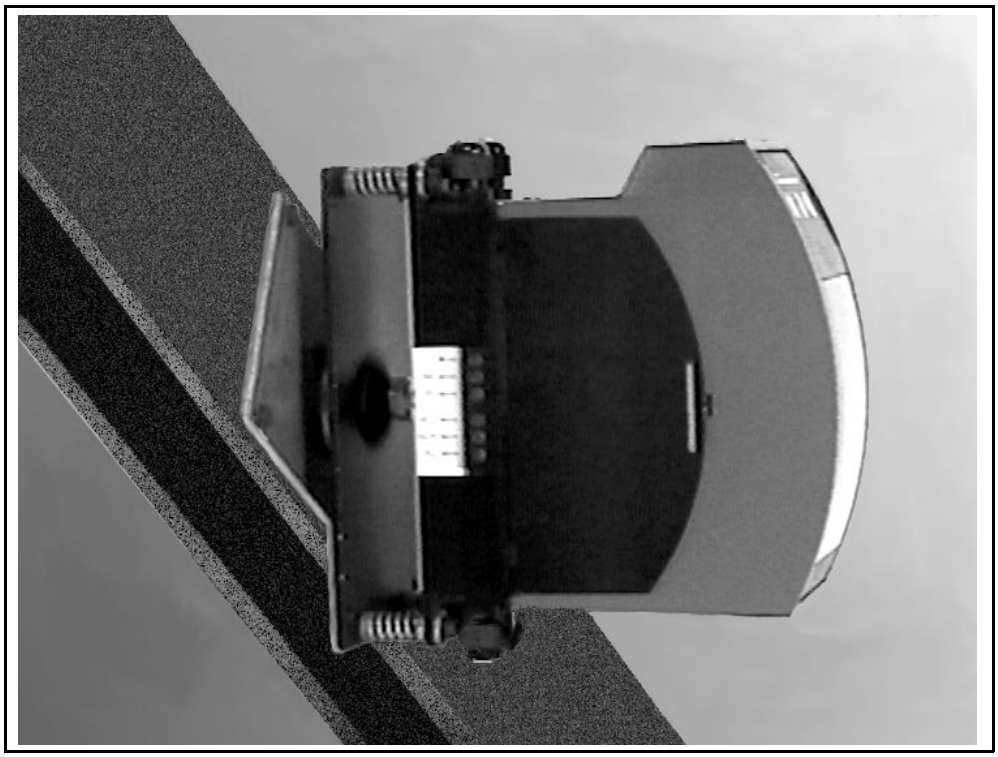

Fig. 6.2: Example of an ODT2 secured on an inclined brace

6.2.2 Coarse Alignment

➜ Mount both devices for one transmission path in a mirror-image fashion relative to each other and as close together as possible.

➜ If one side of the transmission path is mobile, move it as close as possible to the other device for the coarse alignment of the devices.

If the distance is sufficiently short, tools such as a level and a measuring staff simplify the work.

Laser alignment aid available on request

Notice

The angle of radiation for the ODT2 is ±1.5°. The adjustment angles, given here for all directions, are 1.5° for fine alignment with the screws on the mounting plate and 4° for the ball-headed plate.

☞ See Chapter 7.2 for fine alignment

6.3 Connection

Attention !

The device must only be connected by an electrician.

If faults cannot be eliminated, the device should be removed from operation and protected against possible use.

Before connecting the device, be sure that the supply voltage is in agreement with the value printed on the name plate.

The mains device for generating the supply voltage for the ODT2 must possess a secure electrical isolation by means of double insulation and safety transformer in accordance with DIN VDE 0551 (fulfills IEC 742).

Be sure that the earthing conductor is correctly connected. Error-free operation is guaranteed only when the device is properly earthed.

Connection

Electrical connection is carried out by means of the screw terminals on the circuit board in the device connection unit.

Removing the optics unit

➜ First loosen the two quick releases at the separation point between the connection unit and optics unit on the upper and lower side of the device. Even when loose, the screws remain safely secured to the optics unit. Pulling forward, carefully pull off the optics unit.

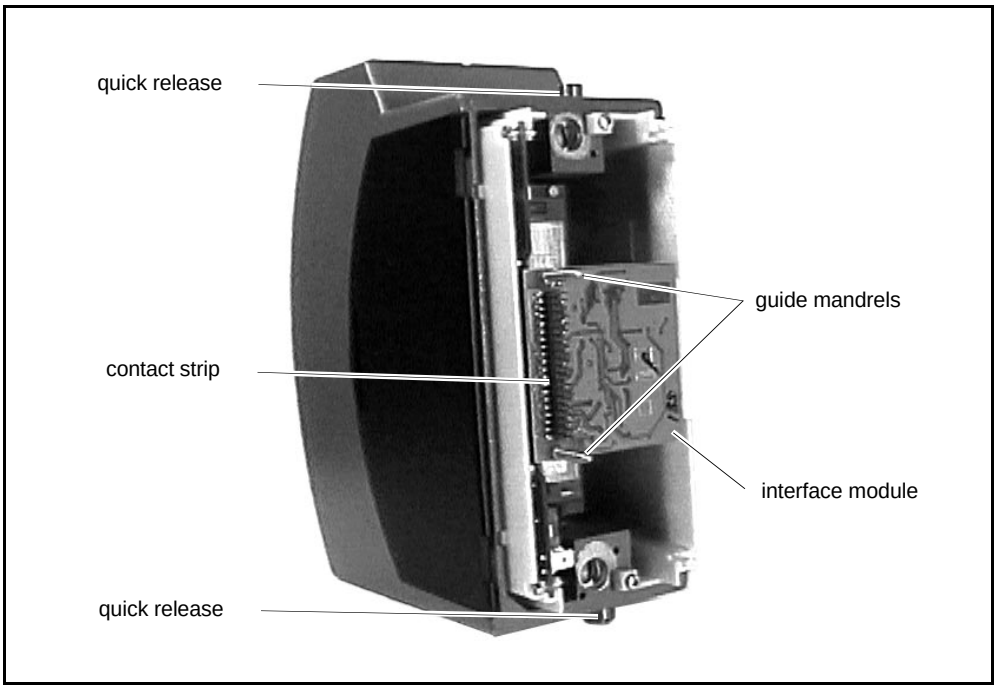

Fig. 6.3.1: Removed optics unit

Attention !

Never place the optics unit on the open side; the guide mandrels, the interface module or the contact strip could otherwise be damaged.

Preparing bus lines

➜ Prepare the cables for the lead and continuation of the bus line as described in Figure 6.3.2. Guide the cables through the appropriate Pg-cable glands and make the connection.

Shielding clamps

➜ With the bus cables ensure that the shielding is connected at both ends, the shield meshing is properly seated and the clamps for the shielding are carefully tightened (see Figure 6.3.2).

Strain relief

➜ For strain relief, finish by tightening the Pg-cable glands.

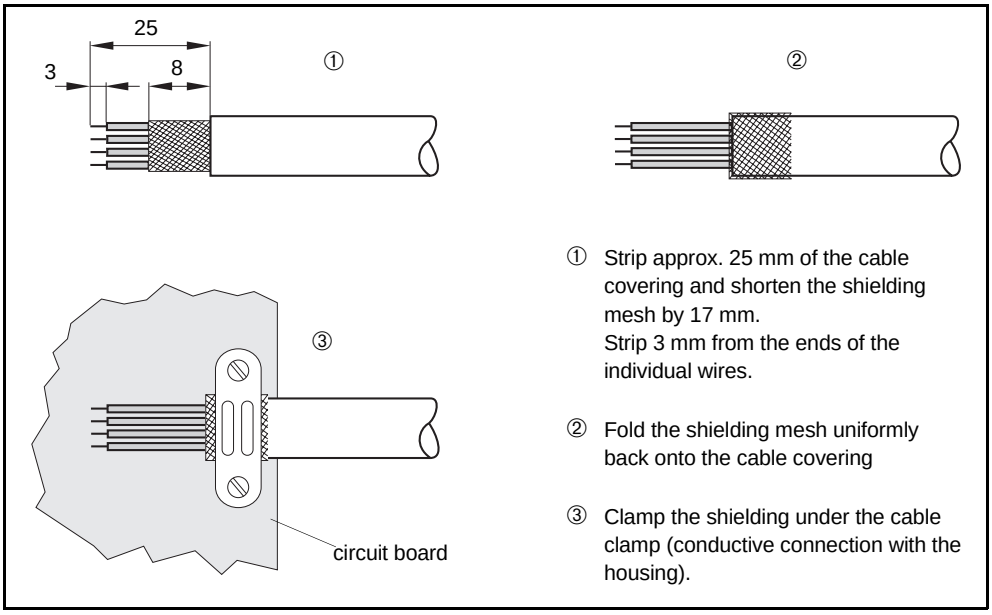

Fig. 6.3.2: Bus cable preparation and shielding connection

Terminal strip Assignment

The terminal strip assignment on the mains-supply side of the circuit board is identical for all versions.

PE	earthing conductor
UB-	
UB+	mains supply
GND	
INTERRUPT	error output signal
GND	
WARNING	warning output signal warning
GND	potential-free input signal
RXD	receiver deactivation
GND	potential-free input signal
TXD	input signal transmitter deactivation

☞ For connecting the bus lines, see Chapters 6.3.1 to 6.3.3 .

6.3.1 ODT2 with Profibus Transmission

At terminal strips A' and B' the bus line coming into A and B can be looped through and guided further. Fig. 6.3.3 illustrates the possible connection cases.

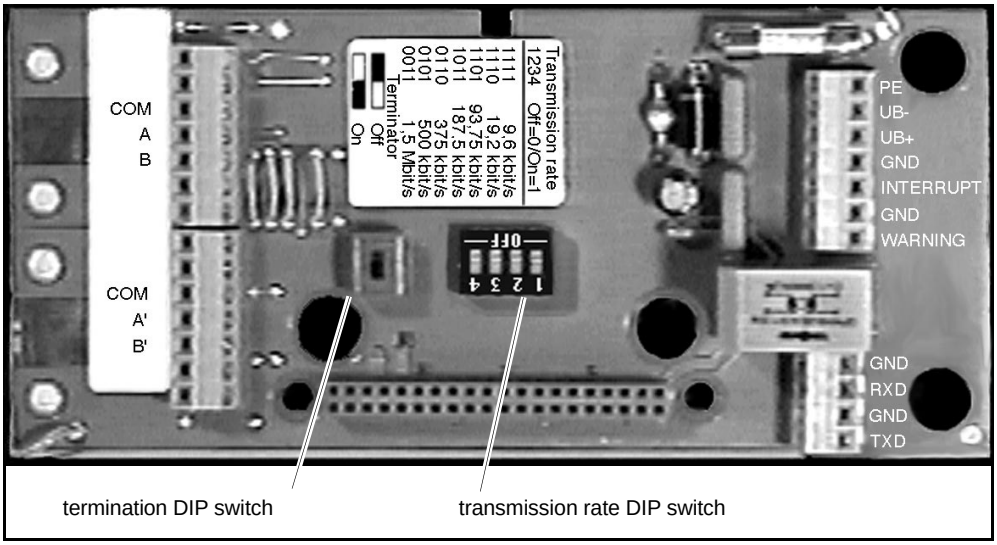

Fig. 6.3.3: Profibus connection unit

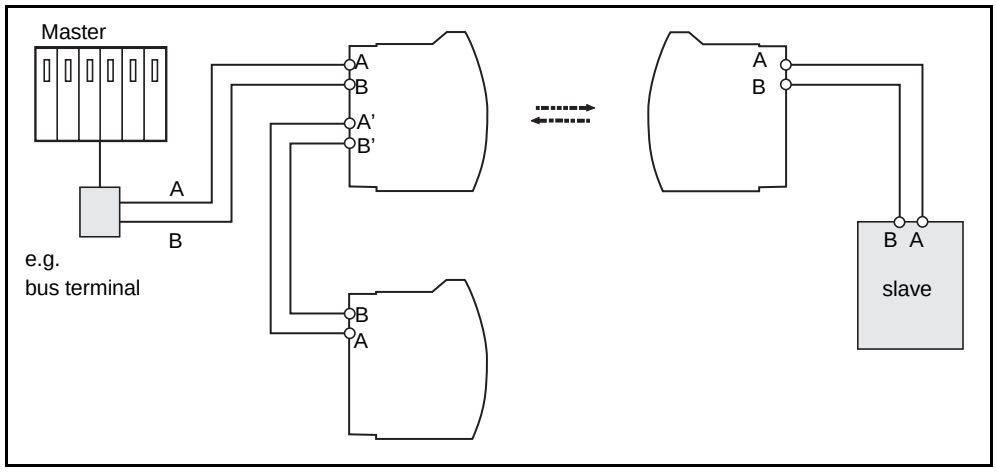

Fig. 6.3.4: Connections for the Profibus interfaces

Terminal Strip Assignment

A	
B	incoming or outgoing bus line
COM	potential equalisation
A'	
B'	looped-through bus line
COM	potential equalisation

If the devices show potential differences of > ±7 Volts within one bus segment, they must be connected through the terminal strips labelled 'COM' for potential equalisation.

Setting the transmission rate

➜ Set the desired transmission rate at the DIP switch on the connection board.

DIP switch coding

Switch	**1234**	
	1111	9.6 kbit/s
	1110	19.2 kbit/s
	1101	93.75 kbit/s
	1011	187.5 kbit/s
	0110	375 kbit/s
	0101	500 kbit/s
	0011	1.5 Mbit/s

Position 0 = off, 1 = on

Termination

DIP switch for termination

At bus segment ends, the data lines must be terminated with a terminating resistor, i.e. ended. ODT2 termination is also made with a DIP switch. The switch is on the board next to the switch for transmission rate.

Attention!

Termination must not take place within a bus segment!

Position 1 = termination off
Position 2 = termination on

Interface module removal/installation

Attention!

Danger of confusion! The interface modules must only be operated on the intended connection units. Device destruction may result if operated on the wrong connection unit.

The interface modules can be damaged by electrostatic charge. Avoid electrostatic charges by wearing an earthing sleeve.

Connection units and interface modules can be combined with one another as follows:

AT2-0010 with IM1-1000	(Profibus)
AT2-0020 with IM2-2000	(INTERBUS RS422)
AT2-0030 with IM2-3000	(INTERBUS bus terminal)

Removal of the interface module is, as a rule, not necessary. For repairing or converting the optic unit, proceed as follows:

Removing the interface module

➜ Remove the optics unit as described in Chapter 6.3 and place it to the side. Loosen the guide mandrels with an open-end wrench (5 mm). Pull the interface module out of the contact strip. To install, carry out the procedure in reverse order.

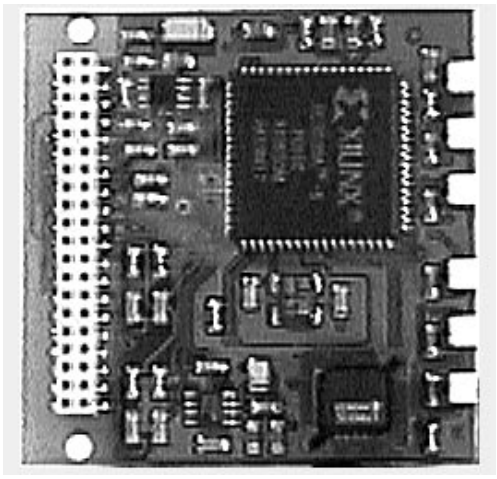

Fig. 6.3.5: Profibus interface module

Cable lengths

The possible cable lengths in a bus segment are influenced primarily by the following parameters:

- type of cable used
- external noise sources
- transmission rate
- number of bus subscribers

The total line length of a bus segment should, with the maximum number of subscribers (32), not exceed the following lengths:

Line lengths and transmission rates

Without repeater:
Cabel A: 200 m at 1500 kbit/s, up to 1.2 km at 93.75 kbit/s
Cable B: 200 m at 500 kbit/s, up to 1.2 km at 93.75 kbit/s

The maximum bus length can be extended to 10 kilometers with the use of repeaters. Depending on the manufacturer, between three and ten repeaters can be used.

6.3.2 ODT2 with INTERBUS Transmission, Point-to-Point Transmission (RS 422)

In the devices connected to one another, terminal strips with the designations Rx (’Receive Data’) and Tx (’Transmit Data), are connected together in pairs as shown in Fig. 6.3.7.

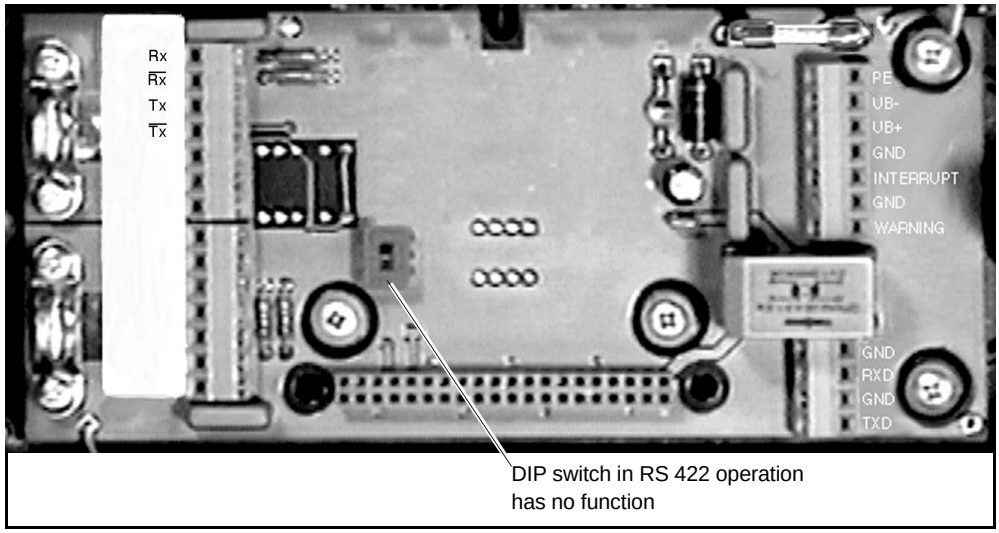

Fig. 6.3.6: Connection unit for point-to-point transmission

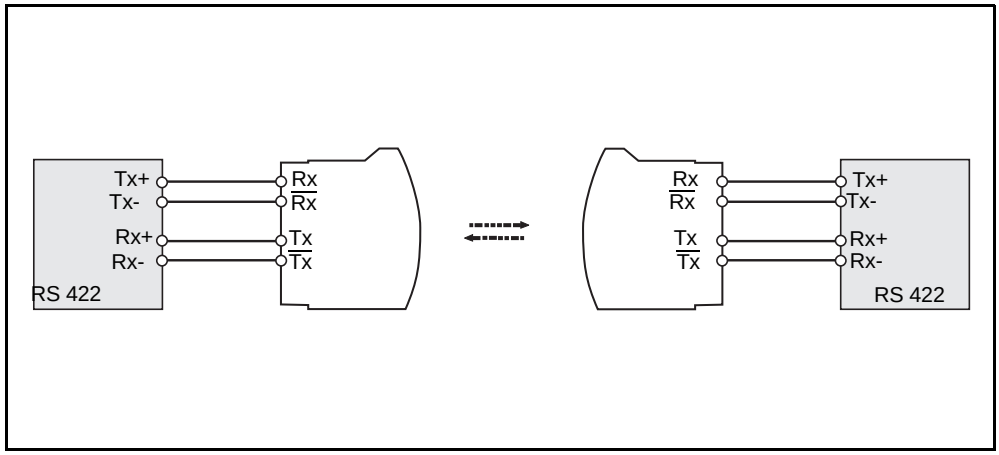

Fig. 6.3.7: Interface connections with point-to-point transmission

☞ See also Fig. 3.6.6

Terminal strip assignment

$\frac{Rx}{\overline{Rx}}$	incoming bus line (Receive Data)
$\frac{Tx}{\overline{Tx}}$	outgoing bus line (Transmit Data)

Transmission rate

The transmission rate is set automatically with the INTERBUS versions.

Removing/installing the interface module

Attention!

Danger of confusion! The interface modules must only be operated on the intended connection units. Device destruction may result if operated on the wrong connection unit.

The interface modules can be damaged by electrostatic charge. Avoid electrostatic charges by wearing an earthing sleeve.

Removal of the interface module is, as a rule, not necessary. For repairing or converting the optic unit, proceed as follows:

➜ Remove the optics unit as described in Chapter 6.3 and place it to the side. Loosen the guide mandrels with an open-end wrench (5 mm). Pull the interface module out of the contact strip. To install, carry out the procedure in reverse order.

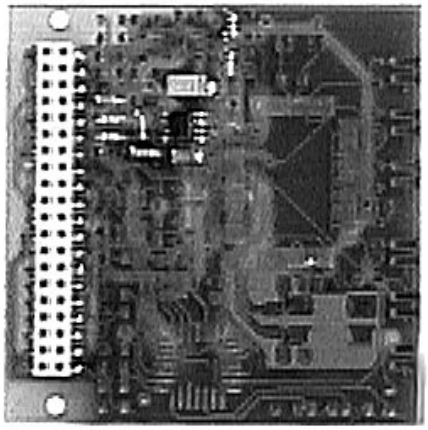

Fig. 6.3.8: RS 422 interface module

Cable lengths

The cable length of a bus segment should not exceed 400 m.

6.3.3 ODT2 with INTERBUS Transmission, ODT2 as Bus Terminal

In the devices connected to one another, terminal strips with the designations DI ('Data In') and DO ('Data Out') are connected together. These are used to differentiate between the master and slave sides.
The master side is closer to the master, i.e. the data flow exiting the master reaches the master side first and then the slave side. The exact wiring is shown in Figures 6.3.9 and 6.3.10.

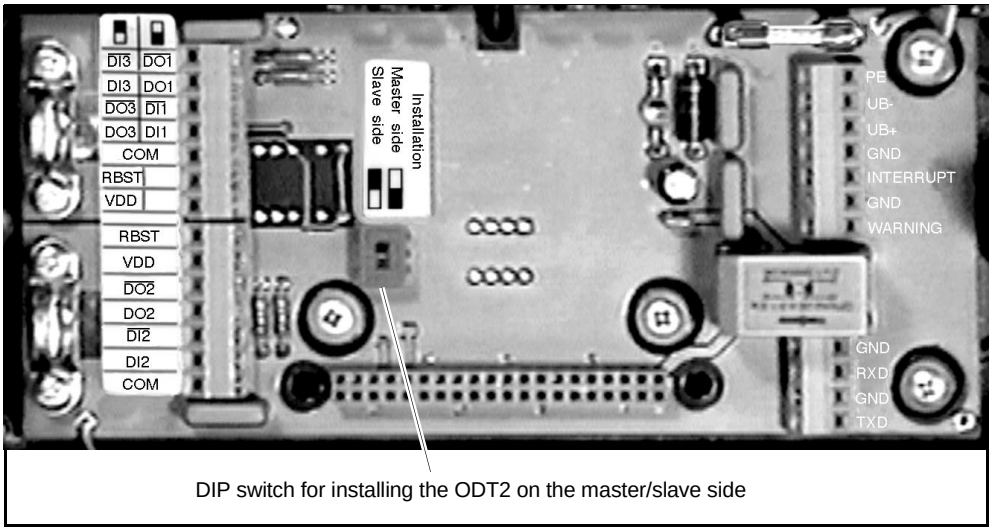

Fig. 6.3.9: INTERBUS connection unit

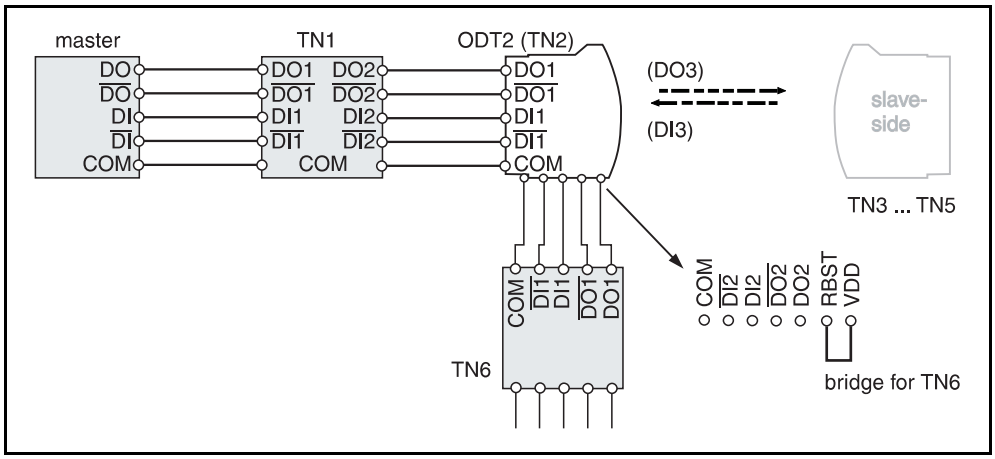

Fig. 6.3.10: Bus terminal connections on the **master side**

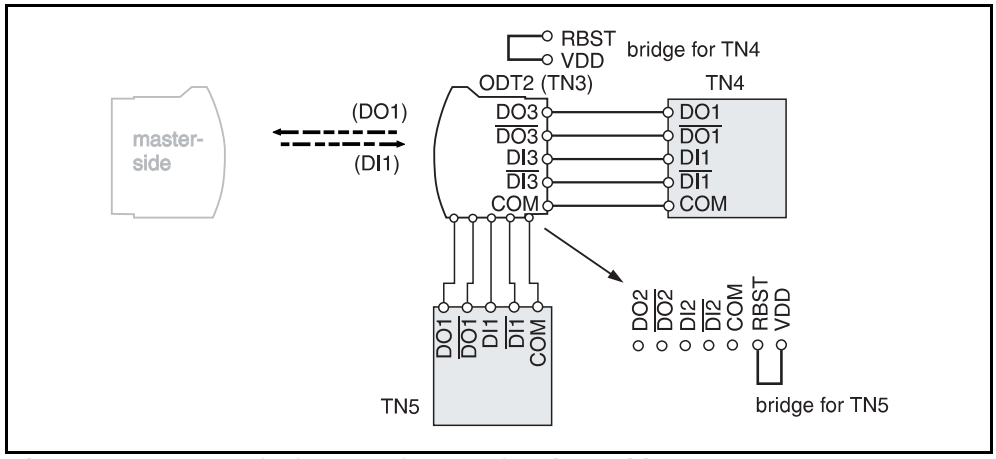

Fig. 6.3.11: Bus terminal connections on the **slave side**

Configuring ODT2 for bus subscribers

Wire bridges for subscribers

Subscribers (TN) immediately following the ODT2 in the INTERBUS must be registered on the terminal strip with wire bridges as described in Figure 6.3.12. If one of the subscribers is not used, the wire bridge provided for it remains open.

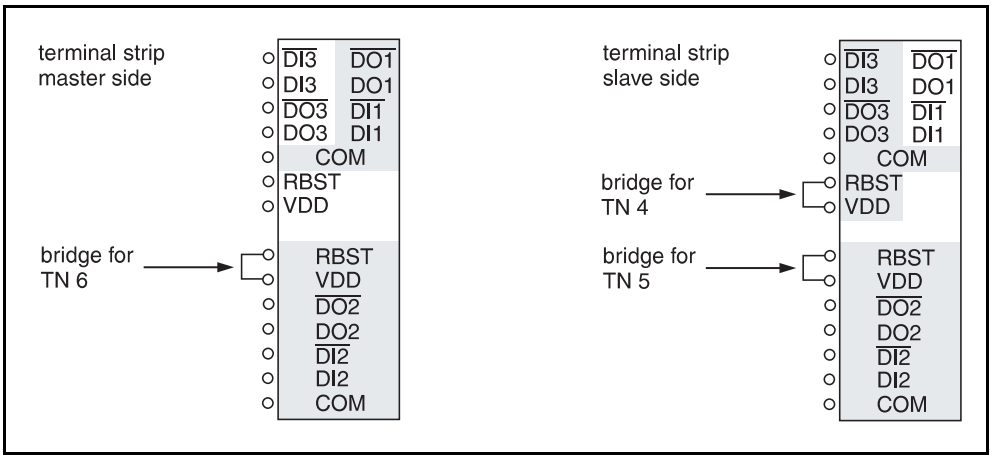

Fig. 6.3.12: Terminal strips used in the master or slave installation

Setting master / slave

DIP switch for setting master / slave

The appropriate DIP switch must be installed on the connection board depending on whether the ODT2 is being installed on the master or slave side of the INTERBUS.

Position 1 = slave side
Position 2 = master side

☞ See Fig. 6.3.9, INTERBUS connection unit

Removing/Installing interface module

Attention!

Danger of confusion! The interface modules must only be operated on the intended connection units. Device destruction may result if operated on the wrong connection unit.

The interface modules can be damaged by electrostatic charge. Avoid electrostatic charges by wearing an earthing sleeve.

Removal of the interface module is, as a rule, not necessary. For repairing or converting the optic unit, proceed as follows:

➜ Remove the optics unit as described in Chapter 6.3 and place it to the side.
Loosen the guide mandrels with an open-end wrench (5 mm).
Pull the interface module out of the contact strip. To install, carry out the procedure in reverse order.

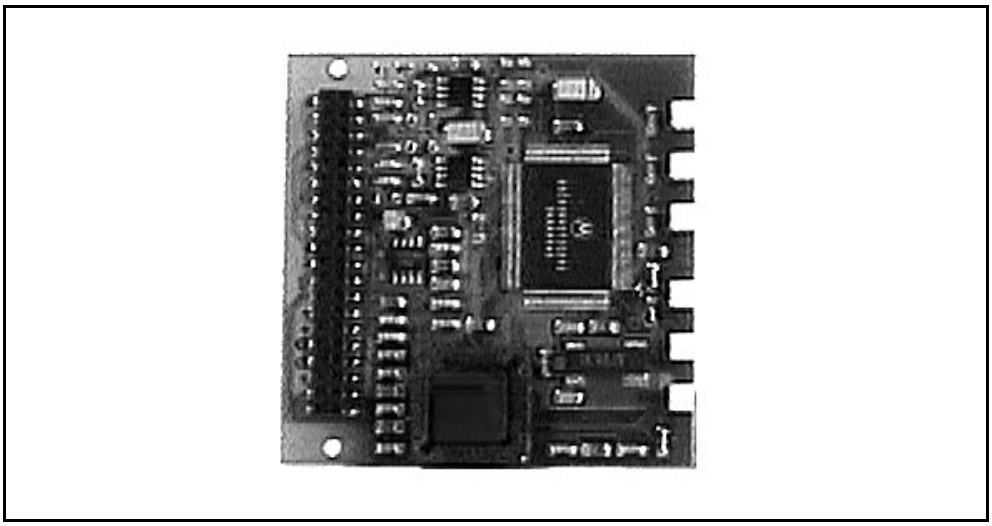

Fig. 6.3.13: INTERBUS interface module bus terminal

Cable lengths

The cable length of a bus segment should not exceed 400 m.

6.3.4 Combined Bus Terminal / Point-to-Point Operation

If no branch is to be made to two subscribers on the slave side, one ODT2 with RS 422 interface is sufficient. The connection is described in Fig. 6.3.14.

Notice:

Diagnostics cannot be used on the slave side in this operating mode. In particular, no warning and error messages can be queried via the bus.

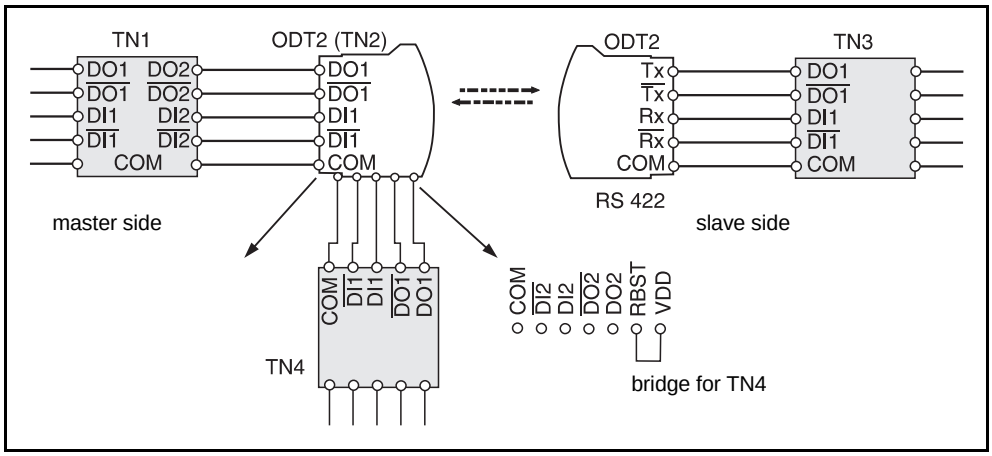

Fig. 6.3.14: Combined bus terminal / point-to-point transmission operation

6.4 Disassembling, Packing, Disposing

Repacking

For later reuse, the device is to be packed so that it is protected against shocks and dampness. Optimal protection is achieved when using the original packaging.

Notice

Electrical scrap is a special waste product! Observe the locally applicable regulations regarding disposal of the product.

The optical data transmission system ODT2 contains no internal batteries which would need to be removed prior to disposal.

7 Commissioning

7.1 Steps Before the First Commissioning

➜ Prior to the first commissioning, familiarise yourself with the operation and adjustment of the device(s)!

➜ Before switching on, recheck all connections and ensure that they have been properly made.

Notice:

A set of short instructions for commissioning are located behind the left retro-reflector (viewed from the optics).

7.1.1 Switching on the Operating Voltage

Before you switch on the operating voltage, be certain that the device has been properly connected.

☞ See Chapter 6.3

After switching on the operating voltage, the device is in the "Normal Operation" operating mode. The ODT2 is thereafter immediately ready for data transmission.

For a first commissioning, carry out the steps shown in Chapter 7.2 ’Alignment’ and Chapter 7.3 ’Test Operation’.

7.2 Alignment

➜ Align the devices with one another as follows:

- Position the devices (if possible) approximately 20 m from one another. In this way, and without too much effort, you obtain an acceptable accuracy.
- Fold out the retro-reflectors on both devices.
- Switch one of the devices into alignment mode by pressing the button with the triangle symbol. The LED next to the button now lights up. Bus operation, as indicated by warning and error messages, is not possible in this mode.

Bar graph as max-hold display

- Use the adjustment tools to rotate one of the devices into the horizontal position in such a way that the bar-graph display shows the maximum deflection. Notice: the bar graph functions as a max-hold display in alignment mode. Pressing the button with the triangle symbol again resets the display.
- Use the same method to determine the vertical alignment.
- Repeat the steps for the second device.
- Fold the retro-reflectors back into both devices.

Testing the transmission path

- Now switch into test mode by pressing the button with the circle symbol on both devices. Carry out the test as described in Chapter 7.3, "Testing the Transmission Path".
- Finally, drive the mobile part of the transmission path through the entire working path while in test mode. If, at some point, the bar graph should drop sharply and transmission errors occur, the devices must be re-adjusted for this position.

The devices are now properly aligned; bus transmission can be started with the button for normal operation (square).

7.3 Testing the Transmission Path

➜ Press the button with the circle symbol for test operation on each of the two devices making up a transmission path one after the other. The upper of the three LEDs next to the button now lights up. Bus operation is not possible in this mode as is indicated by the warning and error messages.

Internal test Each device now tests its data and program memory in a self-test. If no internal errors are present, the middle of the three LEDs next to the button now lights up.

Test transmission The subsequent test transmission tests the transmission path in both directions with the aid of various test bytes. If the transmission functions without problem in both directions, the lower of the three LEDs next to the button lights up.

Transmission error If the LED is blinking, a transmission error is present in at least one of the two transmission directions. If the LED goes out completely, at least one of the two transmission directions is faulty.

Notice

The retro-reflectors can remain folded in for the test transmission.

8 Operation

8.1 Display Elements

The operating status of the ODT2 is displayed by LEDs in the display and control panel (Fig. 8.1) and by means of six LEDs in the device's connection unit.

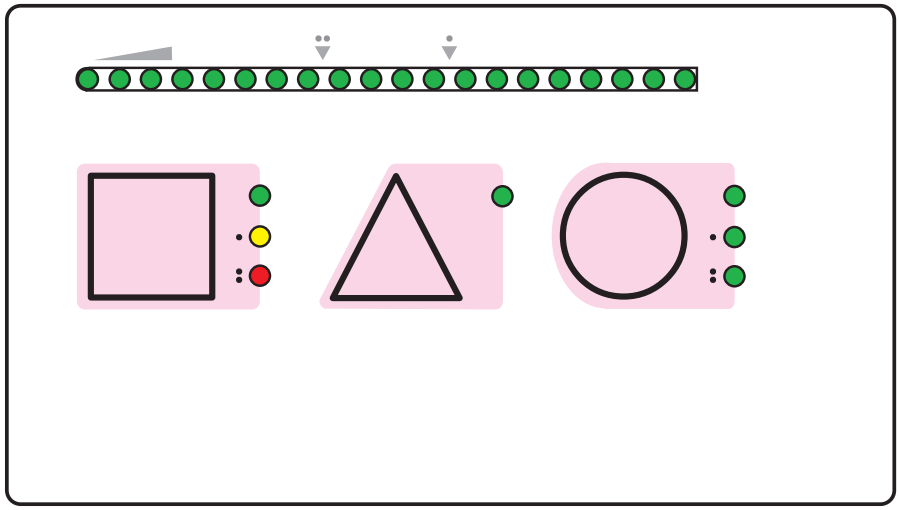

Fig.8.1: ODT2 display and control panel

8.1.1 Bar-graph display

The 20-digit bar graph above the control buttons displays the strength of the received signal. For reliable transmission, the deflections on both devices should lie above the position marked with the small triangle and a dot.

8.1.2 Normal Operation Button

(Square symbol)

LED indicators in normal operation

Upper LED (green):	The ODT2 is running in normal operation. Data are being transmitted.
Centre LED (yellow):	Warning. The strength of the received signal is still sufficient, however, with decreasing performance reserve. A voltage > (U_B - 2 V) is present at the "warning" signal output.
Lower LED (red):	Error. The transmission has been interrupted. A voltage > (U_B - 2 V) is present at the "error" signal output.

Continued on the next page.

8.1.3 Alignment Operation Button

(Triangle symbol)

LED indicator for alignment operation	Upper LED (green)	The ODT2 is running in alignment operation. The retro-reflectors must be folded out. The maximum deflection is retained on the bar-graph display and can be reset by again pressing the triangle button.

8.1.4 Test Operation Button

(Circle symbol)

LED indicators in test operation	Upper LED (green)	The ODT2 is running in test operation. The device first carries out a self-test and then checks the function characteristics of the transmission path.
	Centre LED (green)	No internal errors are present (internal self-test).
	Lower LED (green)	The transmission path is functioning error-free. If the indicator is blinking, bit errors are occurring. If the LED goes out completely, data transmission is not possible.

8.1.5 LED Indicator in the Connection Unit

Display of the transmission rate (PROFIBUS)

When operating in the Profibus system, the set transmission rate is displayed on the six LEDs in the ODT2 connection unit.

Display of diagnosis messages (INTERBUS)

When operating as an INTERBUS bus terminal, diagnosis messages are displayed on the six LEDs in the device's connection unit.

☞ For the diagnosis messages, see Chapter 8.2, Handling Errors

Notice

During point-to-point transmission (RS 422 interface) in the INTERBUS system, the side row of LEDs in the connection unit is without function.

8.2 Handling Errors

Transmission path errors resulting from contamination, misalignment or operation with exceedingly large range are indicated on the ODT2 by the warning and error LEDs and as voltage signals at the corresponding outputs. These outputs can be queried directly at the INTERBUS interface using the INTERBUS protocol.
When operating as an INTERBUS bus terminal, the ODT2's six LEDs also output diagnosis messages.

8.2.1 Monitoring Reception Quality

Should error messages occur, the transmission of transmitted and received data is interrupted. The data are released with a hysteresis: they are not re-released until, in addition to the error messages, the warning messages go out.

Data transmission	Yellow LED	Red LED	Bar graph
no (no optical connection)	on	on	off
no (optical connection made)	on	on	below triangle marking with two dots
good, however with decreasing performance reserve	on	off	between triangle markings
good, with sufficient performance reserve	off	off	above triangle marking with one dot

8.2.2 Diagnosis Messages (INTERBUS Bus Terminal)

The following messages are signalled by means of the LEDs in the ODT2 connection unit:

LED	Color	Meaning
UL	green	supply voltage on: supply voltage present off: supply voltage not present or defective fuse The LED goes out upon triggering of a reset.
RC	green	bus cable check of the incoming bus connection (Remote Bus Check) on: incoming bus connection established off: incoming bus connection faulty
BA	green	remote bus active on: data transmission active off: no data transmission
E	red	error on: an internal error has occurred.
LD	red	local bus disabled on: the I / O modules are disabled.
RD	red	remote bus disabled on: the continuing bus connection is disabled

Moreover, warning and error messages can be queried directly in the INTERBUS system. Here, the warning message corresponds to the warning bit WSO and the error message to the interface cutout signal ASO.

8.2.3 Failures and Correcting Errors

Error	Cause	Correction
Device does not respond (no LEDs light up)	supply voltage polarity false	connect supply voltage correctly
	Defective fuse	replace sensitive fuse (2A) in connection unit
Bus operation not possible	transmission error	see next page
	wiring error	check wiring
	adjustment error (termination, bit rate, configuration)	check settings
	false bus cable	use specified bus cable
	transmitter and/or receiver deactivation wired	check correct wiring / leave terminal strip unwired

Error	Cause	Correction
Transmission error	low reception level due to • misalignment • contamination • operation with exceedingly large ranges	 • Re-align • Clean daylight filter • Observe operating limits
	Influenced by parallel data path	• Operate optical data transceivers with alternating frequency assignment ☞ Fig. 3.6.5 • use devices with smaller openning angles
	Influenced by series-connected data paths	Operate optical data transceivers with alternating frequency assignment ☞ Fig. 3.6.2
	Shielding not connected	Correctly connect shielding
	False bus termination on Profibus	Disconnect and reconnect terminating resistors
	Earthing conductor not connected	Connect earthing conductor
	Strong direct external light	Remove external light source

9 Maintenance

9.1 General Maintenance Information

The optical data transmission system ODT2 does not, in general, require maintenance by the operator.

Cleaning

➜ If the ODT2 optics should become dirty, clean with a soft cloth.

Attention

Do not use an aggressive cleaning material such as thinner or acetone to clean the device.

9.2 Repair, Maintenance

Repairs to the devices other than the exchange of the interface module described in Chapters 6.3.1 ... 6.3.3, must only be carried out by the manufacturer.

☞ Contact your Leuze distributor or service organisation should repairs be required. The addresses are listed on the reverse of this description.