Bus-Capable Optical Data Transmission DDLS 200

Technical Description

PROFIBUS / RS 485 - M12 Connection

1 Safety Notices

1.1 Safety standards

The optical DDLS 200 data transmission system was developed, manufactured and tested in accordance with applicable safety standards. It corresponds to the state of the art. The device series DDLS 200 is "UL LISTED" according to U.S. American and Canadian safety standards, and fulfils the requirements of Underwriter Laboratories Inc. (UL).

1.2 Intended use

The DDLS 200 optical data transmission system has been designed and developed for the optical transmission of data in the infrared range.

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.

Areas of application

The DDLS 200 is suitable for the following areas of application:

- Automated high-bay warehouses
- Stationary data transmission between buildings
- Anywhere, where data transmission to and from stationary or moving objects (visual contact) over relatively long distances (up to 300m) is required.
- Rotary transmission

1.3 Working safely

Attention: Artificial optical radiation!
The DDLS 200 data transmission system uses an infrared diode and is a device of LED Class 1 according to EN 60825-1.

When used under reasonable conditions, devices of LED Class 1 are safe. This even includes the use of optical instruments used for the direct observation of the laser beam.

For the operation of the data transmission system with artificial optical radiation, we refer to directive 2006/25/EC or its implementation in the respective national legislation and to the applicable parts of EN 60825.

Attention!
Access and changes to the device, except where expressly described in this operating manual, are not authorised.

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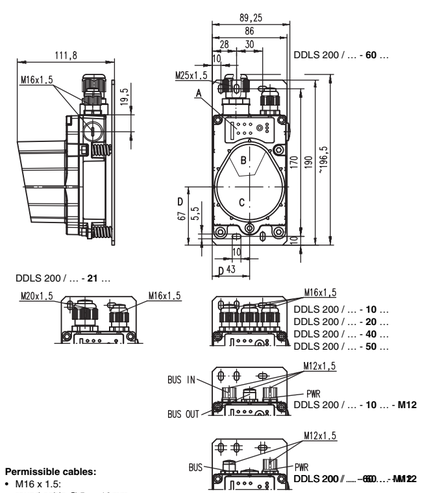
2 Technical Data

2.1 General technical data

Electrical data	
Supply voltage Vin	18 … 30 V DC
Current consumption without optics heating	approx. 200 mA with 24 V DC (no load at switching output)
Current consumption with optics heating	approx. 800 mA with 24 V DC (no load at switching output)
Optical data	
Sensing distance	0.2 … 120 m (DDLS 200/120…) 0.2 … 200 m (DDLS 200/200…) 0.2 … 300 m (DDLS 200/300…)
Transmitter diode	infrared light, wavelength 880 nm
Opening angle	± 0.5 ° with respect to the optical axis for 120m … 300m models.
Ambient light	> 10000 Lux acc. to EN 60947-5-2
LED class	1 acc. to EN 60825-1
Input/output	
Input	0 … 2VDC: transmitter/receiver deactivated 18 … 30VDC: transmitter/receiver activated
Output	0 … 2VDC: normal operation Vin - 2VDC: limited performance reserve output current max. 100mA, short-circuit proof, protected against surge voltage, transients and overheating
Operating and display elements	
Membrane buttons	change of operating mode
Individual LEDs	indicate voltage supply, operating mode, data traffic
LED strip	bar graph display of the receiving level
Mechanical data	
Housing	aluminium diecast; light inlet/outlet, glass
Weight	approx. 1200 g
Protection class	IP 65 acc. to EN 60529
Environmental conditions	
Operating temperature	-5°C … +50°C without optics heating -30°C … +50°C with optics heating (non-condensing)
Storage temperature	-30°C … +70°C
Air humidity	max. 90% rel. humidity, non-condensing
Vibrations	acc. to EN 60068-2-6
Noise	acc. to EN 60068-2-64
Shock	acc. to EN 60068-2-27 and EN 60068-2-29
EMC	acc. to EN 61000-6-2:2005 and EN 61000-6-4:2001
UL LISTED	acc. to UL 60950 and CSA C22.2 No. 60950

2.2 Dimensioned drawing



Permissible cables:
- M16 x 1.5: round cable Ø 5 … 10mm
- M20 x 1.5: round cable Ø 7 … 12mm
- M25 x 1.5: round cable Ø 4.5 … 9mm

A Control panel
B Transmission optics
C Reception optics
D Optical axis

Figure 2.1:Dimensioned drawing DDLS 200

3 Mounting / Installation (all device models)

3.1 Mounting and alignment

An optical data transmission system, consisting of 2 DDLS 200 devices, involves mounting each of the devices on mutually opposing, plane-parallel, flat and usually vertical walls with unobstructed view of the opposing DDLS 200.

Make certain that, at the minimum operating distance A_{min} the optical axes of the devices are aligned with one another within ± A_{min} * 0.01 to ensure that the transmission/reception beams of the two devices lie within the opening angle. This also applies for rotary transmission.

Note
The opening angle (angle of radiation) of the optics is ± 0.5 ° to the optical axis!
For all device models, the horizontal and vertical adjustment angles of the fine alignment with the adjustment screws is ± 6 ° for each. The optical transmission path between the DDLS 200s should not be interrupted. If interruptions cannot be avoided, be sure to read the notice in Kapitel 5.4. Therefore, pay close attention when selecting a suitable mounting location!

Attention!
When laying out a mobile arrangement for a DDLS 200, pay particular attention that the alignment of the devices relative to one another remains unchanged over the transmission path.
The transmission can be interrupted by e.g. jolts, vibrations or inclination of the mobile device due to irregularities in the floor or path.
Ensure adequate track stability!

Mount each device with 4 screws ∅ 5mm using 4 of the 5 fastening holes in the mounting plate of the device (siehe Kapitel 2.2 "Maßzeichnung").

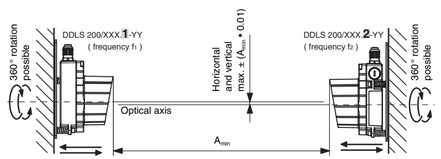


Figure 3.1:Mounting the devices

Note
The fine alignment of the transmission system is performed during commissioning (siehe Kapitel 5.3.2 "Feinausrichtung"). The position of the optical axis of the DDLS 200 can be found in Kapitel 2.2.

3.2 Arrangement of adjacent transmission systems

To prevent mutual interference of adjacent transmission systems, the following measures should be taken in addition to exact alignment:

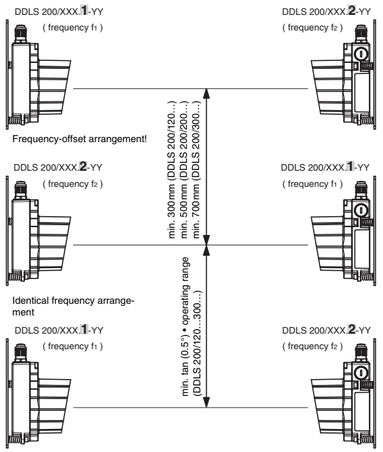


Figure 3.2:Arrangement of adjacent transmission systems

3.3 Electrical connection

Attention!
Connection of the device and maintenance work while under voltage must only be carried out by a qualified electrician.

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

Before connecting the device, be sure that the supply voltage agrees with the value printed on the nameplate.

The DDLS 200… is designed in accordance with safety class III for supply by PELV (Protective Extra Low Voltage, with reliable disconnection).
For UL applications: only for use in class 2 circuits according to NEC.

Be sure that the functional earth is connected correctly. Error-free operation is only guaranteed if the device is connected to functional earth.

The connection of the respective bus system is described in the following chapters.

3.3.1 Electrical connection - devices with M12 connectors

The electrical connection is easily performed using M12 connectors. Ready-made connection cables are available as accessories both for connecting supply voltage/switching input/switching output as well as for connecting the respective bus system.

For all M12 device models, the supply voltage, the switching input and the switching output are connected via the right, A-coded connector **PWR IN** (see figure 3.3).

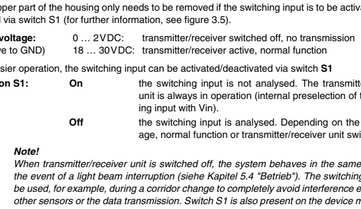


Figure 3.3:Location and designation of the M12 connections

PWR IN (5-pin M12 plug, A-coded)			
PWR IN OUT WARN 2 GND 3 1 Vin FE 4 IN **M12 plug (A-coded)**	**Pin**	**Name**	**Remark**
	1	Vin	Positive supply voltage **+18 … +30VDC**
	2	OUT WARN	**Switching output**, activated if level drops below the warning level
	3	GND	Negative supply voltage **0VDC**
	4	IN	**Switching input** for transmitter/receiver cut-off: **0 … 2VDC**: transmitter/receiver switched off, no transmission **18 … 30VDC**: transmitter/receiver active, normal function
	5	FE	Functional earth
	Thread	FE	Functional earth (housing)

Figure 3.4:Assignment M12 connector PWR IN

Supply voltage

Connect the supply voltage including functional earth according to the pin assignments (see figure 3.4).

Switching input

The DDLS 200 is equipped with a switching input **IN** (pin 1), via which the transmitter/receiver unit can be switched off, i.e. no infrared light is transmitted and at the bus terminals the corresponding bus bias level is present / the bus driver is high resistance.

The upper part of the housing only needs to be removed if the switching input is to be activated/deactivated via switch S1 (for further information, see figure 3.5).

Input voltage: (relative to GND)
0 … 2VDC: transmitter/receiver switched off, no transmission
18 … 30VDC: transmitter/receiver active, normal function

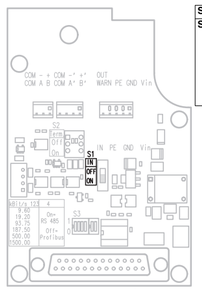
For easier operation, the switching input can be activated/deactivated via switch **S1**

Position S1:
On the switching input is not analysed. The transmitter/receiver unit is always in operation (internal preselection of the switching input with Vin).
Off the switching input is analysed. Depending on the input voltage, normal function or transmitter/receiver unit switched off.

Note!
When transmitter/receiver unit is switched off, the system behaves in the same way as in the event of a light beam interruption (siehe Kapitel 5.4 "Betrieb"). The switching input can be used, for example, during a corridor change to completely avoid interference effects from other sensors or the data transmission. Switch S1 is also present on the device models with M12 connectors.

In order to access switch **S1**, you must first remove the red, upper part of the housing with the optics. To do this, loosen the three housing hex screws. The housing top is now only electrically connected to the base by means of a connector. Carefully pull the housing top straight forward without skewing.

The connection compartment in the housing base with the screwed cable glands is now freely accessible.



Switch	Function
S1	**On (Default):** the switching input is not analysed. The transmitter/receiver unit is always in operation. **Off:** the switching input is analysed. Depending on the input voltage, normal function or transmitter/receiver unit switched off.

Figure 3.5:Location of switch S1

Switching output

The DDLS 200 is equipped with a switching output **OUT WARN** which is activated if the receiving level in the receiver drops.

Output voltage: (relative to GND)
0 … 2VDC: operating range
Vin - 2VDC: warning or shutoff range

The switching output is protected against:short-circuit, surge current, surge voltage, overheating and transients.

Note!
The DDLS 200 is still completely functional when the level of the receiving signal drops to the warning signal level. Checking the alignment, and, if applicable, a readjustment and/or cleaning of the glass pane leads to a significant improvement of the received signal level.

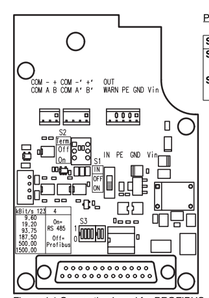
4 PROFIBUS / RS 485

The PROFIBUS model of the DDLS 200 has the following features:

- Operating ranges 120m, 200m, 300m
- Electrically isolated interface
- The DDLS 200 does not occupy a PROFIBUS address
- Integrated repeater function (signal processing), can be switched off
- Protocol-independent data transmission, i.e. transmission of the FMS, DP, MPI, FMS/DP mixed operation protocols
- M 12 connector
- Bus termination via ext. terminator plug
- 6 baud rates configurable (see chapter 4.3)
- Cascading of several DDLS 200 possible

4.1 Settings

If necessary, use switch S3 to adjust the interface type and baud rate settings of the PROFIBUS segment.



PROFIBUS switch

Switch	Function
S3-1 … S3-3	Setting the baud rate of the PROFIBUS segment
S3-4	Changeover PROFIBUS (Off) / RS 485 (On)

Figure 4.1:Connection board for PROFIBUS model with terminals and screwed cable glands

4.2 PROFIBUS connection - devices with M12 connectors

The electrical connection of the PROFIBUS is easily performed using M12 connectors. Ready-made connection cables are available as accessories both for connecting the incoming bus as well as for connecting the continuing bus.

For all M12 device models, the connection is made via the two left, B-coded connectors **BUS IN** and **BUS OUT** (see figure 4.2).

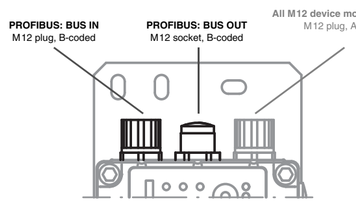


Figure 4.2:Location and designation of the M12 PROFIBUS connections

Attention!
Please be sure to observe the installation requirements (bus cables, cable lengths, shielding, etc.) defined in the PROFIBUS standard EN 50170 (Vol. 2).

4.3 Device configuration PROFIBUS

Bus termination

Note!
*If the PROFIBUS network begins or ends at the DDLS 200 (not a continuing bus), the **BUS OUT** connection must be terminated with the TS 02-4-SA terminator plug, which is available as an optional accessory.*

In this case, please also order the TS 02-4-SA terminator plug.

Adjustment of the transmission rate

You must set the transmission rate of your PROFIBUS segment using the three DIP switches S3-1 through S3-3. Possible transmission rates are:

- 9.6 kBit/s
- 19.2 kBit/s
- 93.75 kBit/s
- 187.5 kBit/s [1)]
- 500 kBit/s [1]
- 1500 kBit/s [1)]

Set the transmission rate in accordance with the table printed on the connection circuit board (see figure 4.1). The default setting is:

- 1500kBit/s for DDLS 200 PROFIBUS device models with M12 connection

Changeover PROFIBUS / RS 485 (default: 'Off' = PROFIBUS)

The DDLS 200 has, as a standard function, a repeater function (signal processing) and is, with regard to the PROFIBUS, to be viewed as a repeater.

Note!
Please observe the guidelines specified in EN 50170 (Vol. 2) regarding the use of repeaters. The delay time of a data transmission path is maximum 1.5 µs + 1 T_{Bit}.

It is also possible to transmit other RS 485 protocols.For PROFIBUS applications, S3-4 should be set to 'Off' ('0').DIP-switch S3-4 can be used to switch off the repeater function for non-PROFIBUS applications (S3-4 = 'On'). In this case, no signal regeneration takes place; the RS 485 protocol must, however, still provide certain features
Please contact the manufacturer if you would like to use the DDLS 200 for general RS 485 protocols.

1. Not for 500m operating range!

5 Commissioning / Operation (all device models)

5.1 Indicator and operating elements

All DDLS 200 device models have the following indicator and operating elements:

- Bar graph with 10 LEDs
- Operating mode LEDs AUT, MAN, ADJ
- Operating mode buttons

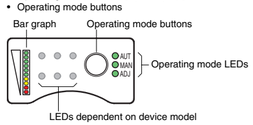
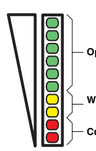


Figure 5.1:Indicator and operating elements common to all DDLS 200 device models

Bar graph

The bar graph displays the quality of the received signal (receiving level) at its own (operating modes "Automatic" and "Manual") or opposing (operating mode "Adjust") DDLS 200 (figure 5.2).



Operating range: Good receiving level, optical data transmission active, performance reserve, output **OUT WARN** not active (0 … 2VDC)

Warning range: Receiving level in the warning range, continued error-free data transmission, no performance reserve, output **OUT WARN** active (Vin - 2VDC), peripheral error message with INTERBUS fibre optic cable model

Cut-off range: Receiving level minimal, optical data transmission separated, output **OUT WARN** active (Vin - 2VDC)

Figure 5.2:Meaning of the bar graph for displaying the receiving level

Changing the operating mode

AUT –> MAN Press the operating mode button for more than 2 seconds.
Only the device on which the button was pressed switches to the "Manual" operating mode (**MAN** LED illuminates).

MAN –> ADJ Press the operating mode button on one of the two devices.
Both devices switch to the "Adjust" operating mode (both **ADJ** LEDs illuminate) when both were previously in the "Manual" operating mode.

ADJ –> MAN Press the operating mode button on one of the two devices.
Both devices switch to the "Manual" operating mode (both **MAN** LEDs illuminate).

MAN –> AUT Press the operating mode button for more than 2 seconds.
Only the device on which the button was pressed switches to the "Automatic" operating mode (**AUT** LED illuminates).

Note!
*If, while in the AUT operating mode, the operating mode button is pressed for longer than 13s, the device switches to a special diagnostic mode. The **AUT**, **MAN** and **ADJ** LEDs illuminate simultaneously.*

To switch to the "Adjust" (ADJ) operating mode, both devices belonging to a transmission path must first be in the "Manual" (MAN) operating mode. It is not possible to switch directly from the "Automatic" to the "Adjust" operating mode or vice versa.

5.3 Initial commissioning

5.3.1 Switch on device / function check

After applying the operating voltage, the DDLS 200 first performs a self-test. If the self-test is successfully completed, the **PWR** or **UL** LED illuminates continuously and the DDLS 200 switches to the "Automatic" operating mode. If the connection to the opposing device exists, data can be transmitted immediately.

If the **PWR** or **UL** LED flashes after switching on, there are two possible causes: either a hardware error has occurred or the transmitter/receiver unit has switched off via the switching input **IN**(“Schalteingang” auf Seite 8).

If the **PWR** or **UL** LED remains dark after switching on, there is either no voltage supply present (check connections and voltage) or a hardware error has occurred.

5.4 Operation

In running operation ("Automatic" operating mode) the DDLS 200 operates maintenance-free. Only the glass optics need to be cleaned occasionally in the event of soiling. This can be checked by analysing the switching output **OUT WARN** (with the INTERBUS fibre optic cable model, a peripheral error message is also available). If the output is set, soiling of the DDLS 200's glass optics is often the cause (see chapter 5.5 "Maintenance/Cleaning").

It must still be ensured that the light beam is not interrupted at any time.

Attention!
If, during operation of the DDLS 200, the light beam is interrupted or one of the two devices is switched voltage free, the effect of the interruption on the entire network is equivalent to the interruption of a data line!

In the event of an interruption (light beam interruption or switched voltage-free), the DDLS 200 switches off the network to a non-interacting state. The system reactions in the event of an interruption are to be defined together with the supplier of the PLC.

5.5 Maintenance/Cleaning

The optical window of the DDLS 200 is to be cleaned monthly or as needed (warning output). To clean, use a soft cloth and a cleaning agent (standard glass cleaner).

Attention!
Do not use solvents and cleaning agents containing acetone. Use of improper cleaning agents can damage the optical window.

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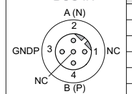
BUS IN (5-pin M12 plug, B-coded)			
	**Pin**	**Name**	**Remark**
	1	**NC**	Not used
	2	**A (N)**	Receive/transmit data A-line (N)
	3	**GNDP**	Data reference potential
	4	**B (P)**	Receive/transmit data B-line (P)
	5	**NC**	Not used
M12 plug (B-coded)	**Thread**	**FE**	Functional earth (housing)

Figure 4.3:Assignment M12 connector BUS IN

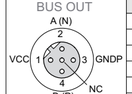
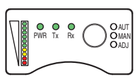
BUS OUT (5-pin M12 socket, B-coded)			
	**Pin**	**Name**	**Remark**
	1	**VCC**	5VDC for bus terminator (termination)
	2	**A (N)**	Receive/transmit data A-line (N)
	3	**GNDP**	Data reference potential
	4	**B (P)**	Receive/transmit data B-line (P)
	5	**NC**	Not used
M12 socket (B-coded)	**Thread**	**FE**	Functional earth (housing)

Figure 4.4:Assignment M12 connector BUS OUT

4.4 LED Indicators PROFIBUS

In addition to the indicator and operating elements present in all device models (bar graph, buttons, LEDs AUT, MAN, ADJ; siehe Kapitel 5.1 "Anzeige- und Bedienelemente"), the PROFIBUS model also has the following indicators:



LED **PWR**: green = operating indicator
green flashing = transmitter/receiver unit switched off via switching input **IN** or hardware error
off = no operating voltage

LED **Tx**: green = data are being transmitted to the bus
green flashing = with baud rates set to very low values, the LEDs **Tx** and **Rx** flicker. At very high baud rates (> 50kBit/s), flashing LEDs **Tx** and **Rx** indicate faulty bus communication.
off = no data on the transmission line

LED **Rx**: green = data are being received by the bus
green flashing = with baud rates set to very low values, the LEDs **Tx** and **Rx** flicker. At very high baud rates (> 50kBit/s), flashing LEDs **Tx** and **Rx** indicate faulty bus communication.
off = no data on the reception line

Figure 4.5:Indicator/operating elements for the PROFIBUS model

Operating mode LEDs

The three green LEDs **AUT**, **MAN** and **ADJ** indicate the current operating mode (see chapter 5.2 "Operating modes") of the DDLS 200.

- **AUT**: operating mode "Automatic"
- **MAN**: operating mode "Manual"
- **ADJ**: operating mode "Adjust"

Operating mode buttons

With the operating mode button, you can switch between the three operating modes "Automatic", "Manual" and "Adjust" (see chapter 5.2 "Operating modes").

5.2 Operating modes

The following table provides an overview of the DDLS 200 operating modes.

Operating mode	**Description**	**Optical data transmission**	**Bar graph assignment**
Automatic, **AUT** LED illuminates	Normal operation	Active	Its own receiving level, display of the alignment quality of the opposing device
Manual, **MAN** LED illuminates	Adjustment operation, cut-off threshold on higher level	Active	Its own receiving level, display of the alignment quality of the opposing device
Adjust, **ADJ** LED illuminates	Adjustment operation, cut-off threshold on higher level	Separated	Receiving level of the opposing device, display of the alignment quality of own device

5.3.2 Fine adjustment

If you have mounted and switched on the two DDLS 200s of a given optical transmission path and they are both in the "Automatic" operating mode, you can perform the fine adjustment of the devices relative to one another with the aid of the three alignment screws.

Note!
Note that with "alignment", the transmitter with the beam which is to be positioned as exactly as possible on the opposing receiver is always meant.
At the maximum sensing distance, the bar graph does not show end-scale deflection even with optimal alignment!

The DDLS 200 supports fast and easy fine adjustment. The **optimisation of the alignment** between the two devices of one transmission path can be performed **by just one person**. Use the following descriptive steps as a set of numbered instructions:

1. Both devices are located close to one another (> 1m). Ideally, the bar graphs of both devices display maximum end-scale deflection.
2. Switch both devices to "Manual" (**MAN**) by pressing the button for a relatively long time (> 2s). Data transmission remains active, only the internal cut-off threshold is changed to the warning threshold (yellow LEDs).
3. While in the "Manual" operating mode, move until data transmission of the DDLS 200 is interrupted. You can normally give the vehicle a run command up to the end of the lane. The vehicle stops immediately upon interruption of data transmission. The devices are not yet optimally aligned with one another.
4. Briefly press the button to switch both devices to the "Adjust" operating mode (**ADJ**). Data transmission remains interrupted.
5. The devices can now be individually aligned. The result of the alignment can be read directly in the bar graph.
6. When both devices are aligned, briefly pressing the button on one of the devices is enough to switch both back to the "Manual" operating mode (**MAN**). Data transmission is again active; the vehicle can continue its path. If data transmission is interrupted again, repeat steps 3 through 6.
7. If the data transmission and the alignment are OK through the end of the path of motion, switch both devices back to the "Automatic" (**AUT**) operating mode by pressing the button for a relatively long time (> 2s). The optical data transceiver is now ready for operation.

6 Troubleshooting (Fax template, please enlarge!)

6.1 General causes of errors

General	❑ Check alignment, tension spring elements of the adjustment plate ❑ Clean inlet/outlet glass ❑ Check wiring ❑ Check shield ❑ Eliminate possible interfering light sources
PWR - LED does not illuminate	❑ Check device supply
PWR - LED flashes	❑ Check wiring of switching input and/or switch position **S1**
ADJ - LED flashes	❑ Select the same operating mode (AUT or MAN or ADJ) on **both** devices ❑ Path not optimally aligned, check alignment ❑ Check device pairing (a path consists of one device which uses frequency f1 and one which uses frequency f2)

6.2 Bus-specific causes of errors

General	❑ Check cables (see Kapitel 4.2) ❑ Check settings
TX - LED does not illuminate	❑ Check cables (see Kapitel 4.2) ❑ Check settings (baud rate, termination)
RX - LED illuminates	❑ Check cables (see Kapitel 4.2) ❑ Check settings (baud rate, termination)

Your data:

Company:
Contact person:
Tel.:

Leuze electronic Fax: +49 (0)7021 / 9850957