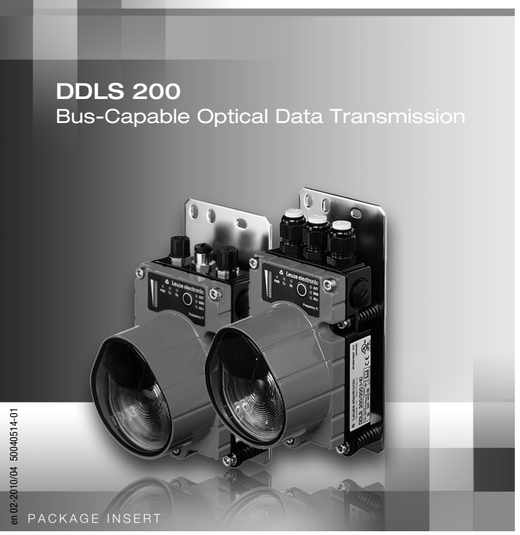
Leuze electronic

the sensor people

DDLS 200
Bus-Capable Optical Data Transmission



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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 500 m) 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 authorized.

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 ° to the optical axis
Ambient light	> 10000 Lux according to EN 60947-5-2:2008
Laser safety class	1 acc. to EN 60825-1:2001
Input/output	
Input	0 … 2 VDC: transmitter/receiver deactivated 18 … 30 VDC: transmitter/receiver activated
Output	0 … 2 VDC: normal operation Vin - 2 VDC: limited performance reserve output current max. 100 mA, 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	aluminum diecast; light inlet/outlet, glass
Weight	approx. 1200 g
Protection class	IP 65 acc. to EN 60529:2000
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 60068-2-6:1996
Noise	acc. to EN 60068-2-64:2009
Shock	acc. to EN 60068-2-27:1995 and EN 60068-2-29:1995
EMC	acc. to EN 61000-6-2:2006 and EN 61000-6-4:2007
UL LISTED	acc. to UL 60950 and CSA C22.2 No. 60950

2.2 Dimensioned drawing

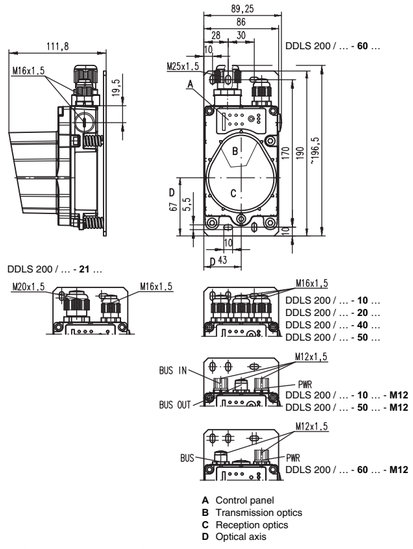

Figure 2.1:Dimensioned drawing DDLS 200

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° (wide angle: ± 1.0° or 1.5°) 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 chapter 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 ∅ 5 mm using 4 of the 5 fastening holes in the mounting plate of the device (see chapter 2.2 "Dimensioned drawing").

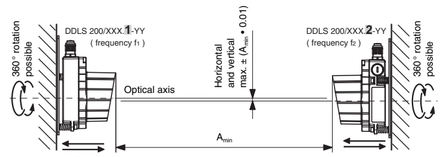

Figure 3.1:Mounting the devices

Note
The fine alignment of the transmission system is performed during commissioning (see chapter 5.3.2 "Fine adjustment"). The position of the optical axis of the DDLS 200 can be found in chapter 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:

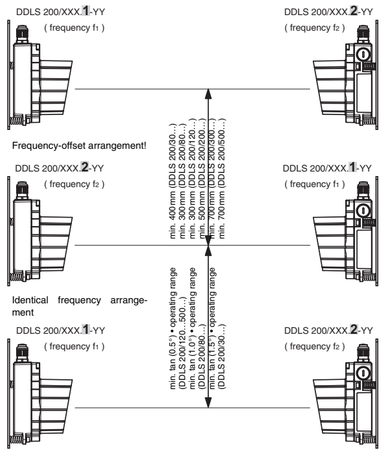

Figure 3.2:Arrangement of adjacent transmission systems

- In the case of an **offset frequency arrangement**, the **distance between two parallel** data transmission paths must not be less than
  - **400 mm** (DDLS 200/**30**…)
  - **300 mm** (DDLS 200/**80**…)
  - **300 mm** (DDLS 200/**120**…)
  - **500 mm** (DDLS 200/**200**…)
  - **700 mm** (DDLS 200/**300**…)
  - **700 mm** (DDLS 200/**500**…)

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- In the case of **identical frequency arrangement**, the **distance between two parallel** data transmission paths must be at least
  - **400 mm + tan (1.5°) • operating range** (DDLS 200/**30**…)
  - **300 mm + tan (1.0°) • operating range** (DDLS 200/**80**…)
  - **300 mm + tan (0.5°) • operating range** (DDLS 200/**120**…)
  - **500 mm + tan (0.5°) • operating range** (DDLS 200/**200**…)
  - **700 mm + tan (0.5°) • operating range** (DDLS 200/**300**…)
  - **700 mm + tan (0.5°) • operating range** (DDLS 200/**500**…)

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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.

Described in the following two sub-chapters is the electrical connection of the supply voltage, the input and the output.

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

3.3.1 Electrical connection - devices with screwed cable glands and terminals

To establish the electrical connections, you must first remove the red housing top 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.

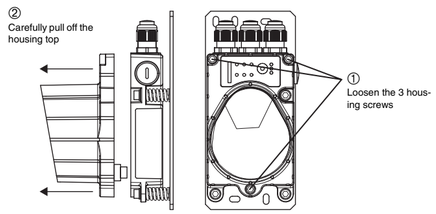
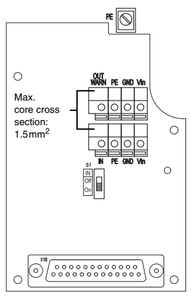


Figure 3.3:Removing the housing top

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



Terminal	Function
Vin	Positive supply voltage **+18 … +30 VDC**
GND	Negative supply voltage **0 VDC**
PE	**Functional earth**
OUT WARN	**Switching output**, activated if level drops below the warning level
IN	**Switching input** for transmitter/receiver cut-off: **0 … 2 VDC**: transmitter/receiver switched off, no transmission **18 … 30 VDC**: transmitter/receiver active, normal function

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

Figure 3.4:Positions of the general, non-bus-specific terminals and switches

Supply voltage

Connect the supply voltage, including the functional earth, to the spring terminals labeled **Vin**, **GND** and **PE** (see figure 3.4).

Note
The connection terminals Vin, GND and PE are provided double to simplify wiring through the supply voltage to other devices.

The functional earth can alternatively be connected at the screw terminal in the housing base (max. core cross section 2.5mm²)

If you would like to wire through the supply voltage, you should replace the filler plugs on the right side of the housing base with an M16 x 1.5 screwed cable gland and guide the continuing supply voltage cable through this gland. The housing seal is, in this way, ensured (Protection Class IP 65).

The housing top can be removed and replaced while under voltage.

Switching input

The DDLS 200 is equipped with a switching input **IN**, 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.

Input voltage: (relative to GND)	0 … 2 VDC: 18 … 30 VDC:	transmitter/receiver switched off, no transmission 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 analyzed. The transmitter/receiver unit is always in operation (internal preselection of the switching input with Vin).
	Off	the switching input is analyzed. 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 (see chapter 5.4 "Operation").

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.

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 … 2 VDC: Vin - 2 VDC:	operating range 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.

3.3.2 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 3.5).

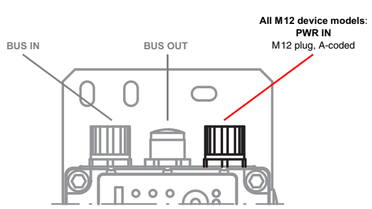


Figure 3.5:Location and designation of the M12 connections

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

Figure 3.6:Assignment M12 connector PWR IN

Supply voltage

Connect the supply voltage including functional earth according to the pin assignments (see figure 3.6).

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 3.3, figure 3.4 and "Switching input" on page 10).

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

For easier operation, the switching input can be activated/deactivated via switch **S1** (see chapter 3.3.1, figure 3.3 and figure 3.4):

Position S1:	**On**	the switching input is not analyzed. The transmitter/receiver unit is always in operation (internal preselection of the switching input with Vin).
	Off	the switching input is analyzed. 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 (see chapter 5.4 "Operation").

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.

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 … 2 VDC: Vin - 2 VDC:	operating range 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.

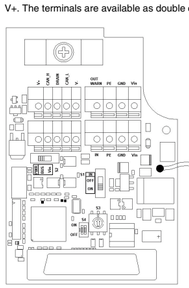
4 DeviceNet / CANopen

The DeviceNet/CANopen model of the DDLS 200 has the following features:

- Operating ranges 120 m, 200 m, 300 m
- The DDLS 200/___-50 can transmit both DeviceNet as well as CANopen protocols
- Electrically isolated interface
- The DDLS 200 does not occupy an address
- CAN controller acc. to 2.0B standard
- Can simultaneously process 11-bit and 29-bit identifiers
- 8 baud rates can be set (10, 20, 50, 125, 250, 500, 800 kBit/s, 1 MBit/s)
- Baud rate conversion possible
- With DDLS 200 it is possible to extend the overall size of a CAN network
- M12 connector set available as accessory
- Various supply options are possible for the device
- Cascading of several DDLS 200 is possible (see Technical description)

4.1 Electrical connection DeviceNet / CANopen - screwed cable glands/terminals

The electrical connection to DeviceNet / CANopen is made at terminals V-, CAN_L, DRAIN, CAN_H, V+. The terminals are available as double connectors for wiring through the bus.



No.	Terminal	Cable color	Function
1	V-	black	neg. supply (CAN ground reference)
2	CAN_L	blue	bus signal (LOW)
3	DRAIN	transparent	shield
4	CAN_H	white	bus signal (HIGH)
5	V+	red	pos. supply

Switch	Position	Function	
S2	BUS	bus transceivers are supplied via the bus cable (V- and V+ lines)	
	Vin **default**	bus transceivers are supplied via internal DC/DC converters	
S3	0 **default**	125 kBit baud rate	CANopen / DeviceNet
	1	250 kBit baud rate	CANopen / DeviceNet
	2	500 kBit baud rate	CANopen / DeviceNet
	3	10 kBit baud rate	CANopen
	4	20 kBit baud rate	CANopen
	5	50 kBit baud rate	CANopen
	6	800 kBit baud rate	CANopen
	7	1000 kBit baud rate	CANopen
	8	Reserved	
	9	Reserved	
S4.1	ON	sorting memory is active	
	OFF **default**	sorting memory is deactivated (FIFO)	

Figure 4.1: DeviceNet / CANopen, connection-board variant

Attention!
The maximum permissible current which may pass over terminals V+ / V- is 3A; the maximum permissible voltage is 25 V (11 … 25 V)!

4.1.1 Bus transceiver and device supplied via separate power connection

- Switch S2 = Vin.
- Bus electrically insulated (isolated node)
- CAN_GND must be connected to V-

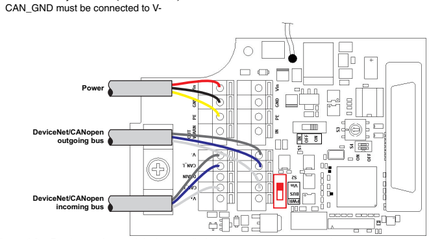


Figure 4.2: Bus transceiver and device supplied via separate power connection

4.1.2 Bus transceiver supplied via bus cable, device supplied via separate power line

- Switch S2 = BUS.
- Bus electrically insulated (isolated node)

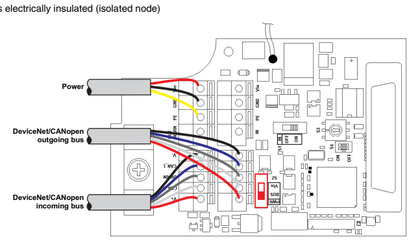


Figure 4.3: Bus transceiver supplied via bus cable, device supplied via separate power line

4.1.3 Bus transceiver and device supplied via bus cable

- Switch S2 = BUS.
- Bus **not** electrically insulated (non-isolated node)
- Current consumption see chapter 2 "Technical Data".

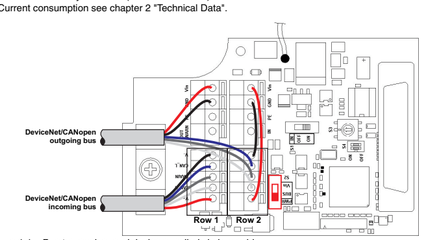


Figure 4.4: Bus transceiver and device supplied via bus cable

Incoming bus cable		Outgoing bus cable	
Cable	**Terminal**	**Cable**	**Terminal**
V- (black)	V- (row 1)	V- (black)	GND
CAN_L (blue)	CAN_L (row 1)	CAN_L (blue)	CAN_L (row 2)
DRAIN (transparent)	DRAIN (row 1)	DRAIN (transparent)	DRAIN (row 2)
CAN_H (white)	CAN_H (row 1)	CAN_H (white)	CAN_H (row 2)
V+ (red)	V+ (row 1)	V+ (red)	Vin
Bridge between Vin and V+ (row 2)			
Bridge between GND and V- (row 2)			

Table 4.1: Connection table

Note!
In order for this interface connection to be conformant with the DeviceNet Ground concept, the load on the switching output and/or the source at the switching input must be potential free.

If the complete device is operated using the supply in the bus cable, it must be ensured that the voltage is at least 18 V.

The total current of the device is the device current plus the current drawn at the switching output.

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4.2 Electrical connection DeviceNet/CANopen - M12 connector

The electrical connection of DeviceNet/CANopen is performed using M12 connectors.

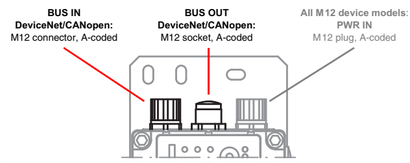


Figure 4.5:Location and designation of the M12 DeviceNet/CANopen connections

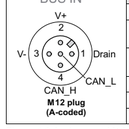
BUS IN (5-pin M12 plug, A-coded)			
BUS IN 	Pin	Name	Remark
	1	Drain	Shield
	2	V+	Positive supply bus transceiver (switch S2 = bus)
	3	V-	Negative supply bus transceiver (switch S2 = bus)
	4	CAN_H	Bus signal High
	5	CAN_L	Bus signal Low
	Thread	FE	Functional earth (housing)

Figure 4.6:Assignment M12 connector BUS IN

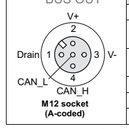
BUS OUT (5-pin M12 socket, A-coded)			
BUS OUT 	Pin	Name	Remark
	1	Drain	Shield
	2	V+	Positive supply bus transceiver (switch S2 = bus)
	3	V-	Negative supply bus transceiver (switch S2 = bus)
	4	CAN_H	Bus signal High
	5	CAN_L	Bus signal Low
	Thread	FE	Functional earth (housing)

Figure 4.7:Assignment M12 connector BUS OUT

Via the selector switch **S2**, the bus transceiver can optionally be supplied via Power or **V+** / **V-**.

S2 = Vin (**default**) bus transceivers are supplied internally

S2 = BUS, bustransceivers are supplied via **V+/V-**.

Attention!
The supply voltage **V+** / **V-** *is 11 … 25VDC.*

Termination

Note!
If the CANopen or DeviceNet network begins or terminates at the DDLS 200 (not a continuing bus), the **BUS OUT** *connection must be terminated with the TS01-5-SA terminator plug (Part No. 50040099), which is available as an option.*

In this case, please also order the TS 01-5-SA terminator plug.

4.3 Device configuration DeviceNet / CANopen

4.3.1 Baud rate conversion

Through the use of an optical transmission system, the bus is divided into two segments. Different baud rates can be used in the physically separated segments. The DDLS 200s then function as baud rate converters. During baud rate conversion, it must be ensured that the bandwidth of the segment with the lower baud rate is adequate for processing the incoming data.

4.3.2 Sorting (switch S4.1)

With the aid of switch S4.1, sorting of the internal memory can be activated and deactivated. If sorting is deactivated (**switch S4.1 = OFF, default**), CAN frames are handled according to the FIFO principle (First-In-First-Out).

If sorting is active (switch S4.1 = ON), CAN frames are sorted according to their priority. The message with the highest priority in memory is the next one to be put onto the connected network for arbitration.

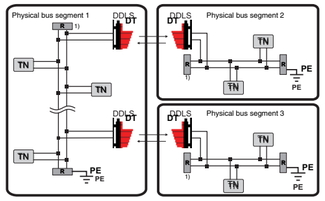
4.3.3 Bus lengths as a function of the baud rate

Switch position S3	Baud rate	max. cable length per bus segment	Interface
0 (default)	125kBit	500m	CANopen / DeviceNet
1	250kBit	250m	CANopen / DeviceNet
2	500kBit	100m	CANopen / DeviceNet
3	10kBit	5000m	CANopen
4	20kBit	2500m	CANopen
5	50kBit	1000m	CANopen
6	800kBit	50m	CANopen
7	1000kBit	30m	CANopen

Note!
The mechanical expansion of the bus system can be increased through the use of the DDLS 200.

4.4 Wiring

- The ends of the bus lines must be terminated between CAN_L and CAN_H for each physical bus segment (see figure 4.8 R).
- Typical CAN cables consist of a twisted-pair cable with a shield that is usually used as CAN_GND. Only use cables recommended for DeviceNet or CANopen.
- The ground reference CAN_GND must only be connected to earth potential (PE) at one place on a physical bus segment (see figure 4.8).



TN = bus subscriber

1) Part of the communication device

Figure 4.8: DeviceNet / CANopen wiring

4.4.1 Termination

DeviceNet

- External termination for M12 connector version is available as an option (see chapter 4.2)
- Resistance and other features are described in the DeviceNet specifications of the ODVA (Open DeviceNet Vendor Association).

CANopen

- Resistance: typically 120Ω (supplied with the device, installed between CAN_L and CAN_H)
- External termination for M12 connector version is available as an option
- Resistance and other features are described in the CANopen specification ISO 11898.

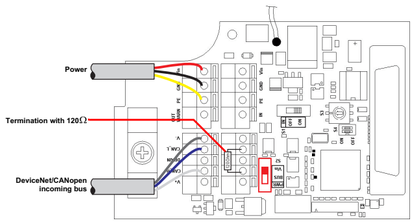


Figure 4.9: Termination in the unit.

A 120Ω resistor is connected standard between terminals CAN_L and CAN_H. If the device is not the last subscriber of the bus segment, the resistor must be removed and the outgoing bus cable connected to the terminal strip.

4.5 DeviceNet/CANopen LED indicators

In addition to the indicator and operating elements present in all device models (bar graph, buttons, LEDs AUT, MAN, ADJ; see chapter 5.1 "Indicator and operating elements"), the DeviceNet/CANopen 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, or with low bus traffic, the LEDs **Tx** and **Rx** flicker.
	off	=	no data are being transmitted to the bus
LED **Rx**:	green	=	data are being received by the bus
	green flashing	=	with baud rates set to very low values, or with low bus traffic, the LEDs **Tx** and **Rx** flicker.
	off	=	no data on the reception line
LED **BUF**:	yellow	=	**bu**ffer load: >70%
	yellow flashing	=	**bu**ffer load: 30% … 70%
	off	=	**bu**ffer load: <30%
LED **ERPA**:	yellow	=	DDLS 200 is in "**Er**ror **Pa**ssive" state, full communication functionality, however in the event of an error, a passive error flag is sent (see also "BOSCH CAN Specification 2.0"). **Measures**: - check termination, wiring, baud rate
	off	=	DDLS 200 is in "Error Active" state, full communication functionality, however in the event of an error, an active error flag is sent, normal state
LED **BOFF**:	yellow	=	DDLS 200 in "**BusOff**" state, does **not** reattempt to participate in bus traffic ⇒ **manual intervention necessary** **Measures**: - check termination, wiring, baud rate - power OFF/ON of the device supply or bus supply
	yellow flashing	=	DDLS 200 in the "**BusOff**" state, but does reattempt to participate in bus traffic
	off	=	DDLS 200 not in the "**BusOff**" state, normal state

Figure 4.10: Indicator/operating elements of the DeviceNet/CANopen model

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

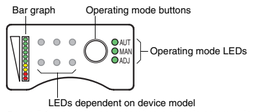
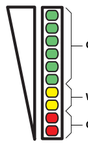


Figure 5.1: Indicator and operating elements common to all DDLS 200 device models

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

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

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**("Switching input" on page 10 and page 12).

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.

5.3.2 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 **optimization 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.

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 analyzing 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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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 wiring ❑ Check settings
BUF - LED flashes/illuminates	❑ Check wiring ❑ Baud rate set incorrectly, check baud rate switch S3 ❑ Incorrect or missing termination, check termination ❑ No further participant connected to the bus, check bus connection ❑ Interference on the bus segment, check with analyzer ❑ Messages are not being sorted, a low-priority message cannot be sent (bottleneck effect), check switch position S4.1 ❑ Bus load generally too high, check bus load
ERPA - LED illuminates	❑ Check wiring ❑ Incorrect or missing termination, check termination ❑ Baud rate set incorrectly, check baud rate switch S3 ❑ No further participant connected to the bus, check bus connection ❑ Interference on the bus segment, check with analyzer
BOFF - LED flashes/illuminates	❑ Check wiring ❑ Switch S2 is on "BUS" and no supply is connected to bus terminals V+ and V-, check switch position S2 ❑ Supply at V+, V- is below specification, measure voltage ❑ Device defect

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