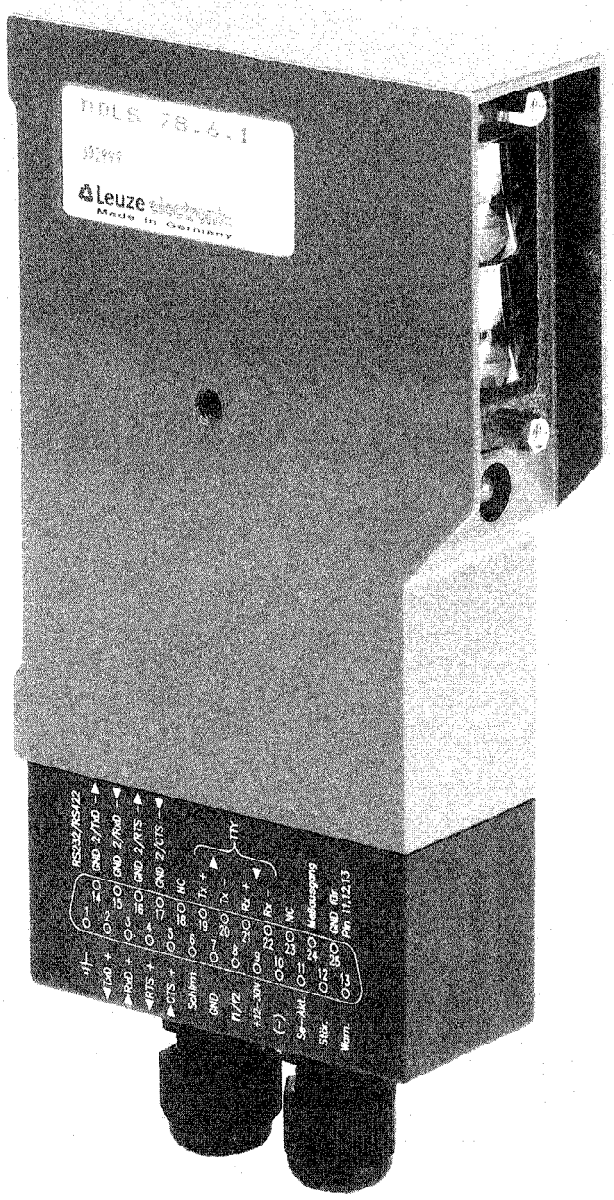
Serial optical data transmission DDLS 78. ...

Technical Description



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1 General

1.1 Explanation of symbols

→ This symbol indicates activities which must be carried out.


This symbol is used in front of places in the text which must be observed without fail. Failure to observe the provided instructions could lead to personal injury or damage to the data transmission units.


This symbol indicates places in the text where supplementary information is offered on the installation and handling of data transmission units.

Italics To permit you to find information quickly, key words are listed in the left-hand column in italics.

1.2 Important terms

DDLS Type designation for Leuze electronic data transmission units with transmitter and receiver accommodated in a single housing.

FSK modulation Modulation by means of frequency shift keying.

Carrier frequency f_1/f_2 Frequency at which data is transmitted from one unit to another. The DDLS work in pairs with two different carrier frequencies f_1 and f_2.

Full duplex Simultaneous transmission and reception of data possible.

Transparent The data transmission units act as a wire substitute. This means that while adjustment is possible, no setting of transmission parameters (e.g. Baud rate) to the data transmission units is necessary.

TTY interface Serial 20 mA current loop interface

RS-232, RS-422, RS-485 interface Serial voltage interfaces

Multifunction display LED with the capability to flash and change from yellow to red; referred to in the following description as multifunction LED or LED.

Lens heating Heating elements used to prevent lens elements from freezing. With the lens heating, frosting is not possible.

IDLE time Bus usage time

2 Safety remarks

Safety standard

The data transmission units of the DDLS series have been developed, produced and tested in compliance with the valid safety standards. They are in line with the state of the art.

Application in accordance with the intended purpose

Data transmission units of the DDLS series may only be used in areas in which interruption of data transmission, for example as a result of masking of the transmitter or receiver lens, cannot lead to damage or personal injury. Data transmission units of the DDLS series must not be used in areas which require absolutely interruption-free data transmission.

Safety-conscious operation

In order to avoid malfunctions:

Optics Clean the transmitter and receiver window of the DDLS regularly. Observe the chapter on "Maintenance".

Alignment Check the alignment of the DDLS at regular intervals.

Lasers A laser alignment aid is provided for alignment of the DDLS. As a result of exposure to heat and photochemical effects, laser beams can be damaging to health. The primary source of danger can be irreparable damage to the eyes. The laser alignment aid described here is categorized as a class 2 device. The laser beam used for alignment lies within the visible spectral range (400 to 700 nm). It is not hazardous to the eyes over a brief radiation period (up to 0.25 s). In order to minimize the danger of accidents when working with the alignment aid, observe the following conditions:

- Only use the laser alignment aid for alignment of the DDLS;
- Before switching on the laser, ensure that there is no-one looking directly into the beam;
- Do not look into the laser beam;
- Do not direct the laser at reflecting surfaces or at people.

Organizational measures

Documentation Pay attention without fail to the instructions contained in this technical information leaflet, in particular this "Safety Remarks" section. Also observe valid local legislation and regulations of the relevant industrial supervisory bodies.

Qualified staff Installation, commissioning and maintenance should only be carried out by suitably qualified staff.

Use of the laser alignment aid Before commissioning the laser alignment aid, ensure by means of technical or organizational measures that no-one can be endangered by direct, reflected or scattered laser radiation.

Maintenance and repair Maintenance of the DDLS must be carried out in precise agreement with the instructions provided here. Repairs may only be performed by specialized Leuze servicing technicians.

Other safety regulations

When working with the laser alignment aid, observe the following safety regulations:

VBG 93	Accident prevention regulations governing laser beams
DIN VDE 0837	Radiation safety of laser devices; Classification of units, requirements, user directives

In addition, adhere to local regulations, standards and legislation in the country of use.

3 Description

3.1 Survey of serial data transmission systems

Where data has to be transmitted to and from moving objects, optical data transmission systems provide an ideal solution.

With the DDLS series, Leuze electronic offers a range of efficient optical data transmission units. They are durable in design and are not subject to wear. Through use of a modular construction principle, they can be individually adjusted to the respective application.

There are 4 basic units offered with differing output data.

Type	Range	Transmission rate
DDLS 78.5	0.5 - 120 m	9600 bit/s
DDLS 78.6	0.5 - 200 m	19200 bit/s
DDLS 78.6.1	0.5 - 120 m	19200 bit/s
DDLS 78.7	0.5 - 200 m	38400 bit/s

Every basic unit can be combined with various interfaces (TTY, RS-232, RS-422, RS-485) and various types of connection hardware.

Benefits

The data transmission units of the DDLS series offer a range of benefits, and are characterized by the following features:

- Reduced wiring input – transmitter and receiver are integrated in one housing;
- Simplified storage of units and spares – operation with two identical units;
- High interference immunity and simple wiring – galvanically separate interfaces;
- No transmission interaction due to surface reflections and scattered outside light – FSK modulation;
- Trouble-free data exchange with simultaneous transmission and receipt of data (full duplex mode) – two different carrier frequencies;
- Fast, simple alignment – multifunction LED and analogue output for voltmeter;
- Application in ambient temperatures as low as –35 °C with lens heating;
- Immediate readiness for service – permanently integrated TTY interface;
- Simple adjustment to existing interfaces – exchange of interfaces using plug-in modules (RS-232, RS-422, RS-485);
- Interface conversion possible – use of two different interface modules;
- No setting of transmission parameters possible.

3.2 Structure of the DDLS

The data transmission units of the DDLS series are durable, user-friendly and convenient to service.

The units are based on a modular design principle and comprise:

1 basic unit

2 Connection module

3 Plug-in module for the interface

Installation and adjustment of the DDLS are considerably simplified by using the mounting and adjusting bracket (see accessories).

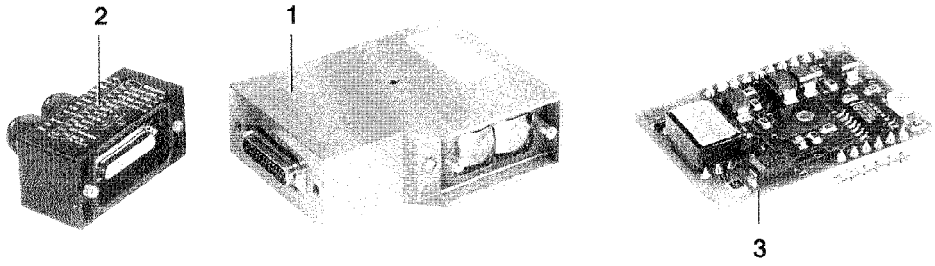


Fig. 1 Structural elements of the DDLS

Components of the DDLS:

1 Bolt for mounting the laser alignment aid

2 Receiver

3 Transmitter

4 Multifunction LED (multifunction display)

5 Connection module

6 Fastening thread for the mounting and adjusting bracket

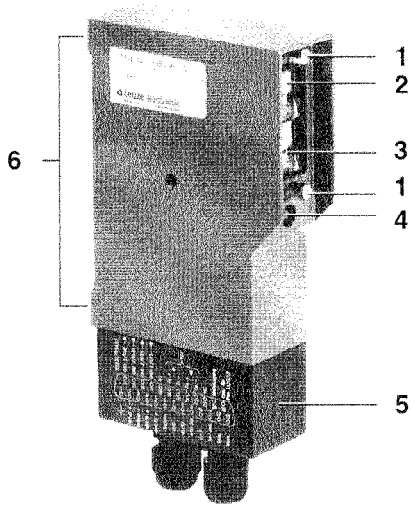


Fig. 2 Components of the DDLS

3.3 Interface characteristics

TTY

- Current loop interface for long supply cables
- High interference immunity
- Point-to-point connection
- 2/4-wire connection
- Power supply via one of the DDLS
- Active and passive operation possible

RS-232

- Unsymmetrical voltage interface for short cables
- PC connections in EDP environments
- Point-to-point connection
- 3-wire connection
- Combined earth potential-carrying return circuit
- Handshake (CTS/RTS)

RS-422

- Symmetrical voltage interface for long cables
- High interference immunity
- Point-to-point and multiple-point connections
- 4-wire connection
- Potential-free
- Handshake (CTS/RTS)

RS 485

- Symmetrical voltage interface for long cables
- High interference immunity
- Point-to-point and multiple-point connections
- Bus capability
- 2-wire connection
- Transmitter and receiver circuits through transceiver: Following the last transmission bit is a pause before transmission starts in the opposite direction.
- Handshake (CTS/RTS)

3.4 Functional characteristics

Transmit/receive

The transmitter converts the electrical signals into light signals by means of a light diode. The receiver converts the light signals back into electrical signals by means of a phototransistor.

Carrier frequency

To ensure that there is no mutual interaction during data transmission in full-duplex operation of the units, two different pairs of frequencies (f_1/f_2) are used. These carrier frequencies are set in pairs at the units by means of bridges.

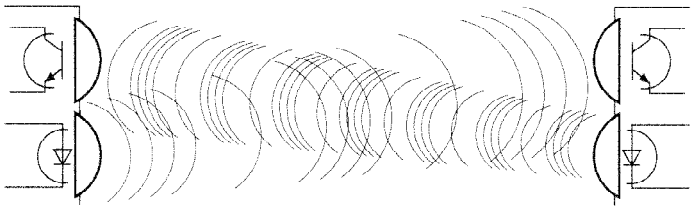


Fig. 3 Transmit-receive principle

FSK modulation

Every unit transmits its signals by means of frequency shift keying (FSK modulation). The information is encoded bit by bit in two frequencies.

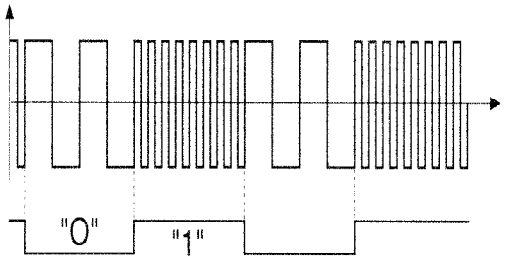
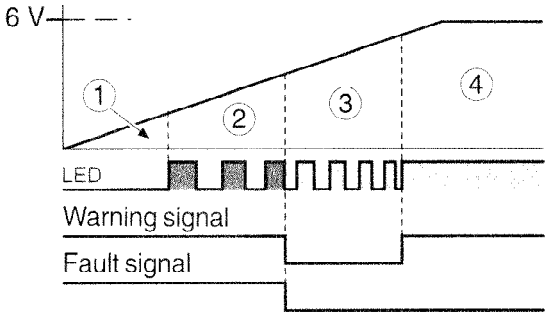


Fig. 4 FSK modulation

The receiver filters the frequencies from the received signal and converts them into a sequence of bits. Superimposed spurious signals, caused for example by light flashes from fluorescent tubes, are filtered out in this way.

Transmission quality

The level of the received signal can be checked at both units.



No.	Data transmission	LED
1	none	off
2	none	red flashing
3	critical	yellow flashing
4	good	yellow

Fig. 5 Check of receive quality

- Multifunction display: The quality of the received signal is indicated.
- For computers or PLC: A warning signal is output at pin 13, a fault signal at pin 12.
- Voltmeter: The level of the received signal can be measured at pin 24.

4 Applications

The optical data transmission units DDLS are used wherever transmission devices using a different system are more elaborate, laborious, susceptible to faults and expensive to operate and maintain.

Optical data transmission units replace for example

- Collector wires;
- Trailing cables;
- Radio connections.

When used in mobile applications, the travel speed and acceleration do not exert any influence on the transmission quality of data.

A difference is drawn in the application of data transmission units between

- Point-to-point connections and

Benefit

- Coupling to bus systems.

4.1 Point-to-point connection

Simple data transmission

Diagnosis, parameter transfer

e.g. communication connections between PC and PLC for

- The transmission of control commands,
- Amendment and checking of control parameters.

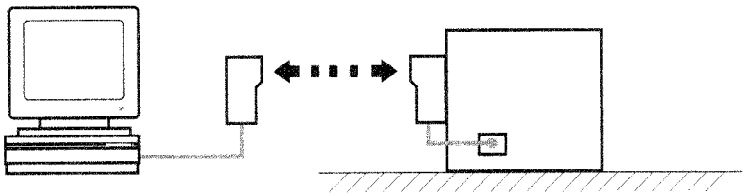


Fig. 6 Stationary data transmission

Communication between two PCs
e.g. data transmission between 2 PCs from one building to the next.

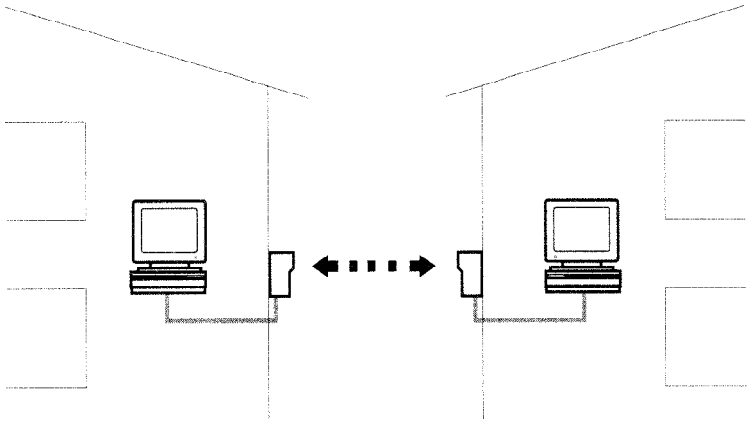


Fig. 7 Building-to-building transmission

Application on transport vehicles
e.g. control of transport vehicles in brickworks, cement works and cargo areas.

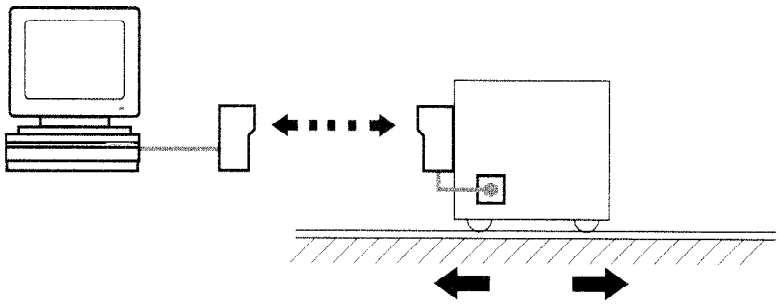


Fig. 8 Transport trucks

Interlinked data transmission
e.g. data transmission applied to flexible production cells

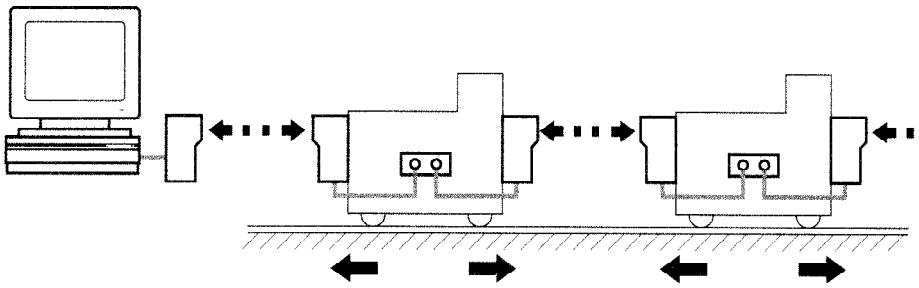


Fig. 9 Flexible production cells

Realization of optical paths

Horizontal-horizontal movement

e.g. data transmission on a travelling crane system with integrated scales

- Extension of maximum range,
- Transmission of weighing data to the printer.

Only the closest unit to the fixed station transmits the weighing data to the printer. Switchover is effected by sensors arranged in the centre of the crane track.

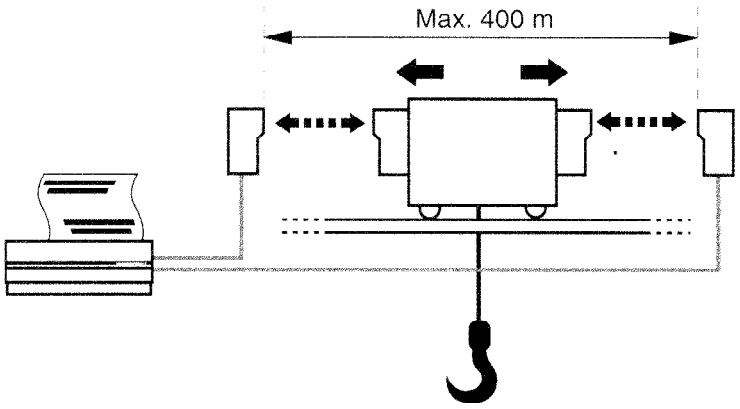


Fig. 10 Travelling crane system

Horizontal - vertical movement

e.g. data transmission in a high-bay warehouse with

- Two moving axes,
- Two data transmission paths: Horizontal (aisle travel) and vertical (raising/lowering),
- Adaptation to existing interfaces through interface conversion.

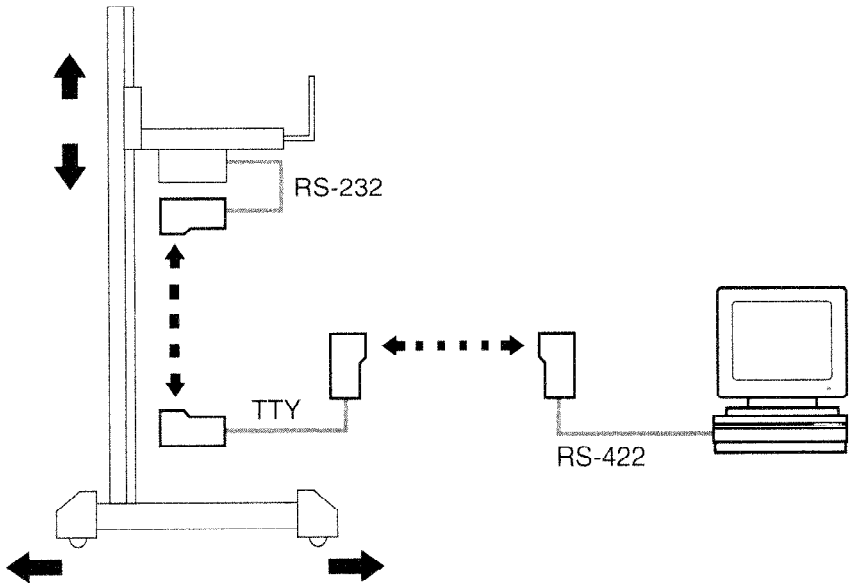


Fig. 11 High-bay warehouse

Two duplex paths in close confinement

In contrast to the DDLS 78.5, 78.6 and 78.7 units, the DDLS 78.6.1 unit operates using red light. This permits compliance with two criteria:

1. The set-up of 2 data transmission paths positioned closer together than 2.5 metres, for example data transmission in two warehouse aisles separated only by a 2 metre-wide rack.

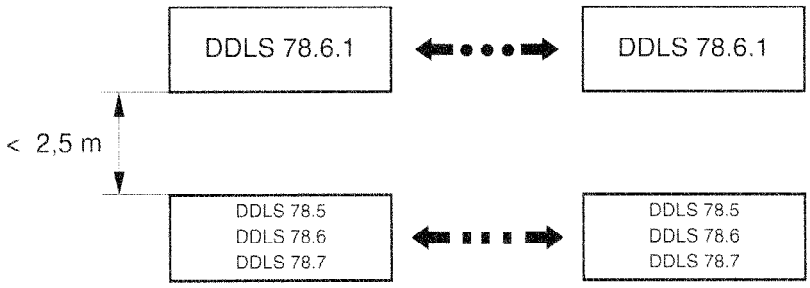


Fig. 12 DDLS mounted in close confinement

2. Wireless two-channel data transmission in a high-bay warehouse for the simultaneous transmission of
   - Orders to a rack handling system (rhs)
   - Diagnosis data and control parameters.

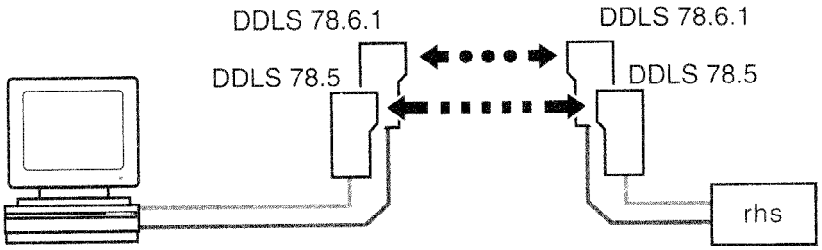


Fig. 13 Two duplex paths

4.2 Coupling to bus systems

Profibus SINEC L2

e.g. coupling of a material flow computer with several connected rack handling systems via Profibus L2.

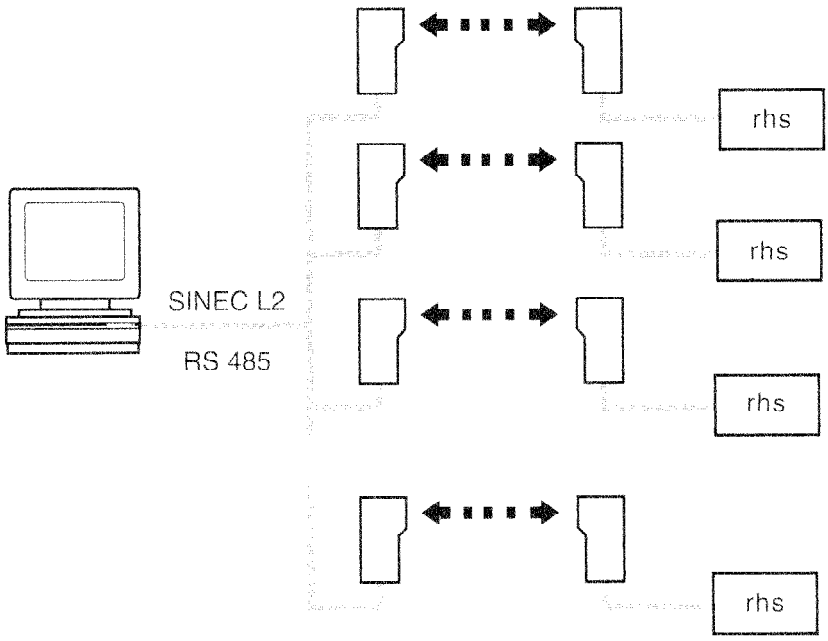


Fig. 14 Bus system

4.3 Parallel data transmission over long distances

This covers for example the transmission of several signals from different signal sources such as optical sensors, PLC, relays etc.
Standard converters convert the waiting parallel signals into serial signals. The DDLS then transmits the serial signals (duplex operation).
These signals can be further processed on the receiver side, for example by valves, control systems, drive systems and so on.

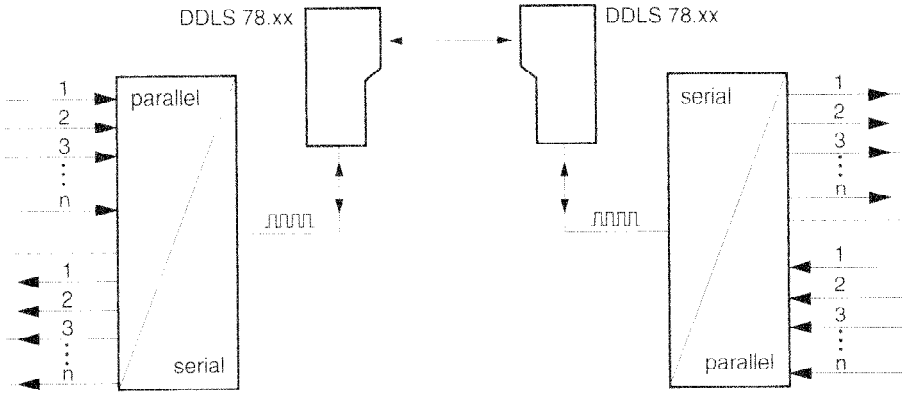


Fig. 15 DDLS and parallel-serial converters

5 Specifications

5.1 General specifications

Manufacturer	Leuze electronic GmbH + Co., D-73277 Owen-Teck

Types

Type	DDLS 78.5	DDLS 78.6	DDLS 78.6.1	DDLS 78.7
Range	0.5 - 120 m	0.5 - 200 m	0.5 - 120 m	0.5 - 200 m
Transm. rate	9600 bits/s	19200 bits/s	19200 bits/s	38400 bits/s

Mechanical data

Housing	Die-cast aluminium
Surface finish	Epoxy powder coated
Colour	RAL 3000
Weight	appr. 340 g
Protection class	IP 65
Optics	glass

Ambient conditions

Operating temperature with lens heating	–20 °C to +60 °C (DDLS 78.5) –35 °C to +60 °C (DDLS 78.6, DDLS 78.7 and DDLS 78.6.1)
Storage temperature	–30 °C to +70 °C

Interfaces

Standard	TTY (current loop 20 mA) permanently installed in unit, activated via plug-in module
Optional	RS-232 plug-in module RS-422 plug-in module RS-485 plug-in module

Power supply

Operating voltage	12 – 30 V DC
Residual ripple	15%
Current consumption (applicable only to TTY)	at +25 °C max. 120 mA at 0 °C max. 150 mA at –35 °C max. 280 mA

Display

Multifunction display	LED, two-colour

Inputs

Transmitter activation (Pin 11)	
Input signal	Transmitter active → $+U_B$
	Transmitter inactive → < 2 V
Transmit-receive	f_1 → GND or NC
carrier frequency (pin 8)	f_2 → $+U_B$

Outputs

Warning output (pin 13)	Open NPN collector, galvanically isolated
Output signal	High – transistor disabled for receive level with performance reserve Low – transistor enabled for receive level with little or no performance reserve
Output load	Max. 50 mA
Suppressor circuit	Against overcurrent and overvoltage
Fault output (Pin 12)	Open NPN collector, galvanically isolated
Output signal	Low – transistor enabled, if receive level suffices for data transmission High – transistor disabled, if receive level too low (no data transmission)
Output load	Max. 50 mA
Suppressor circuit	Against overcurrent and overvoltage
Measurement output (pin 24)	
Voltage range	0 - 6 V DC (6 V → optimum alignment)
Reference potential	GND ($-U_B$) = pin 10
Output load	Max. 10 mA
Electrical connection	Sub-D plug (25-pole) – for soldered connection – with screw terminals – with solder terminal and interface monitoring

Optical data

Transmission medium	
DDLS 78.5 ... 78.7:	Modulated invisible infrared light
DDLS 78.6.1:	Modulated visible red light
Optical beam angle	± 1.5° to optical axis

Measurements
All measurements in mm

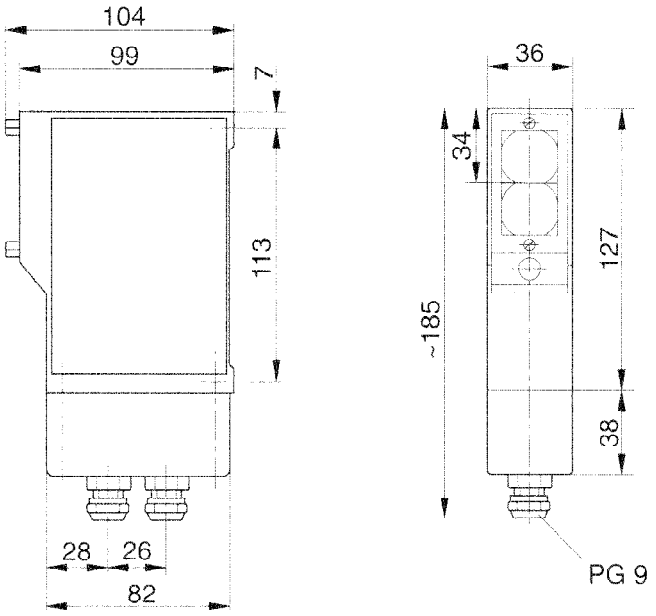


Fig. 16 Measurements

5.2 Interface specifications

Interface	Application, connection	Transmission mode	Transmission rate	Additional current consumption
TTY	Point-to-point Multiple point	Symmetrical Full duplex	max. 20 kbit/s	
RS-232	Point-to-point	Unsymmetrical Full duplex	max. 20 kbit/s	100 mA
RS-422	Point-to-point Full duplex or bus system in semi-duplex mode	Symmetrical Full duplex	max. 38.4 kbits/s	130 mA
RS-485	Point-to-point or bus system (e.g. SINEC L2)	Symmetrical Semi duplex	max. 9.6/19.2/38.4 kbit/s (respective IDLE time adjustable via plug-in jumper on interface module)	150 mA

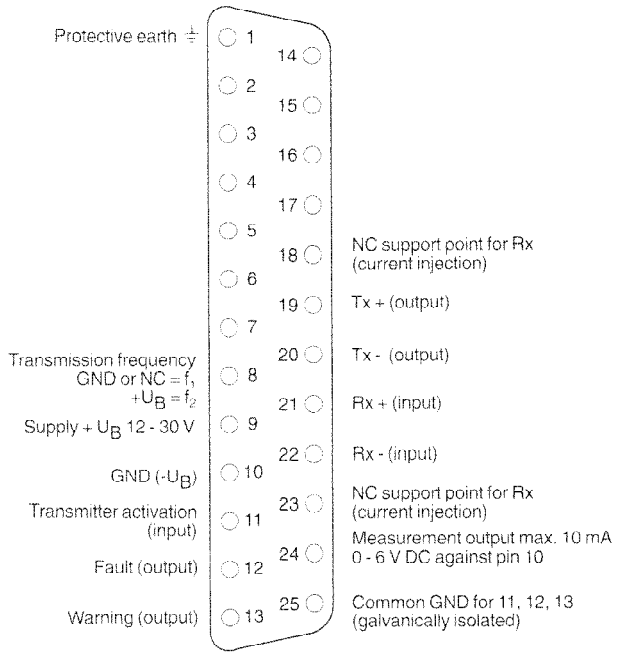


Fig. 17 Plug assignment TTY

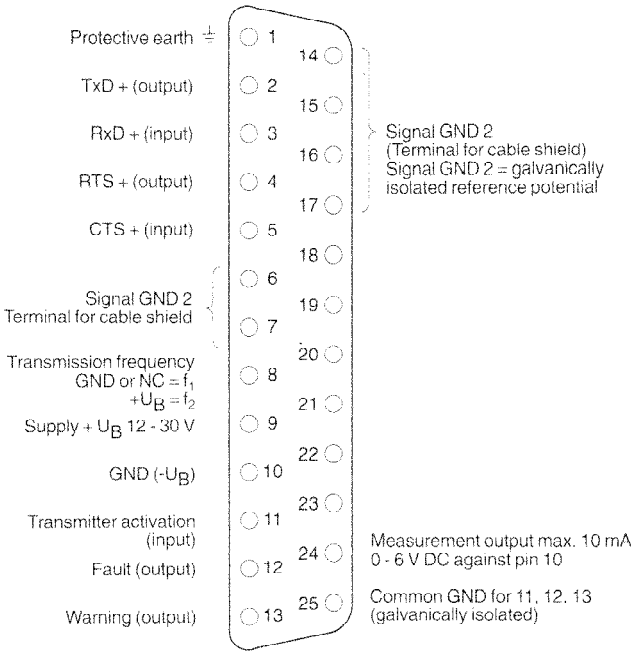


Fig. 18 Plug assignment RS-232

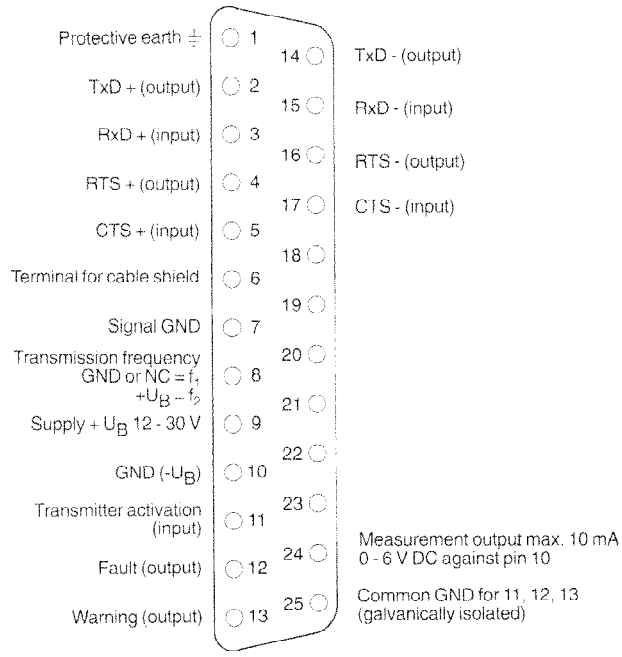


Fig. 19 Plug assignment RS-422

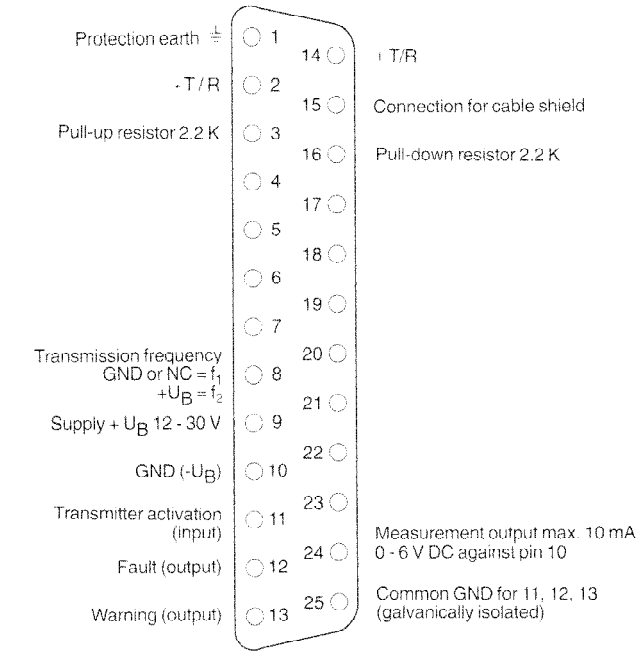


Fig. 20 Plug assignment RS-485

6 Connection examples

6.1 Connection Printer - PC

Application e.g. for "extension" of an RS-232 printer interface.

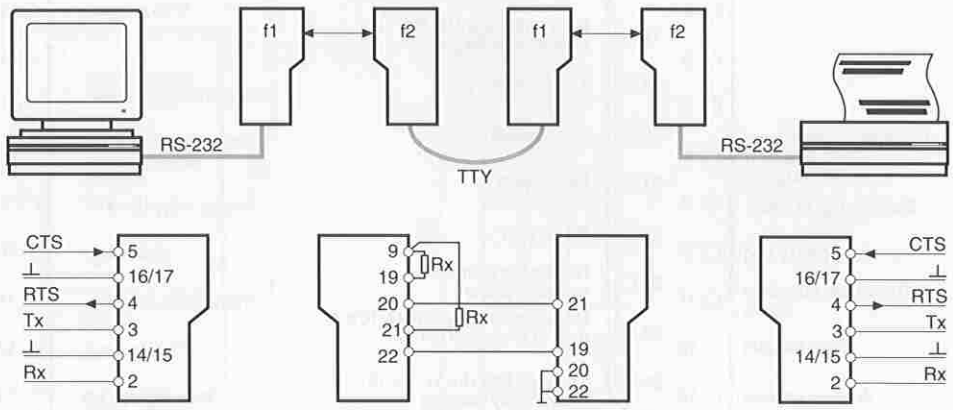


Fig. 21 Connection between printer and PC

Configuration During operation without handshake conductor (CTS/RTS), terminals 4 and 5 of the DDLS with RS-232 interface remain unassigned.

6.2 Connection of communication processors

Application The communication processors CP 525 and CP 525/CP 524 have to be connected via an optical data transmission path.

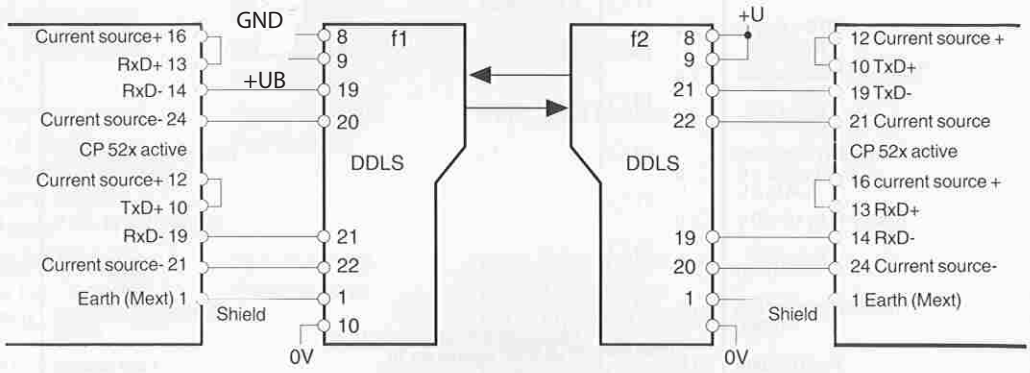


Fig. 22 Connection of communication processors

Configuration The transmit and receive frequencies must be set in pairs. The DDLS 78. ... must be activated (continuous activation).

7 DDLS in bus systems

7.1 Connection DDLS – L1 bus

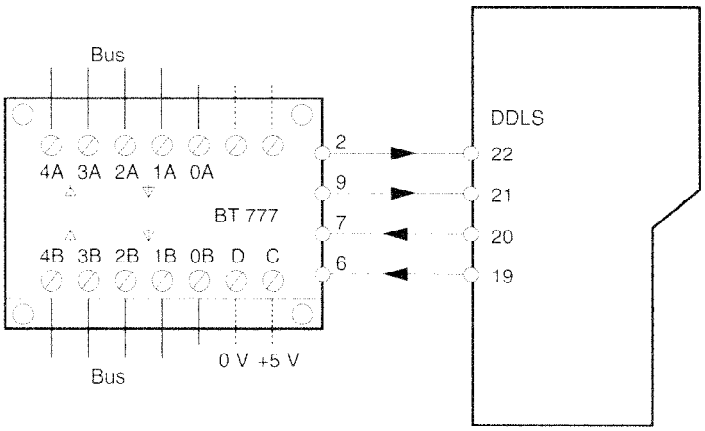


Fig. 23 L1 bus

Configuration

- DDLS 78.xx with TTY interface
- Bus terminal BT-777

7.2 Connection DDLS – L2 bus

The DDLS 78.xx can be connected directly to the L2 bus or via a bus terminal.

Direct: Connection to L2 bus

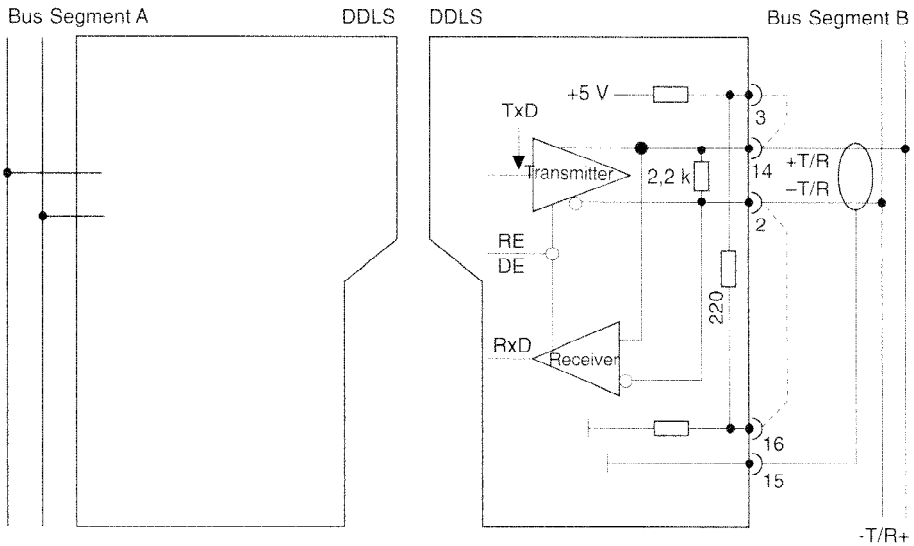


Fig. 24 Connection DDLS - L2 bus

Configuration

- DDLS 78.xx with R-48 interface

Indirect: Connection via bus terminal

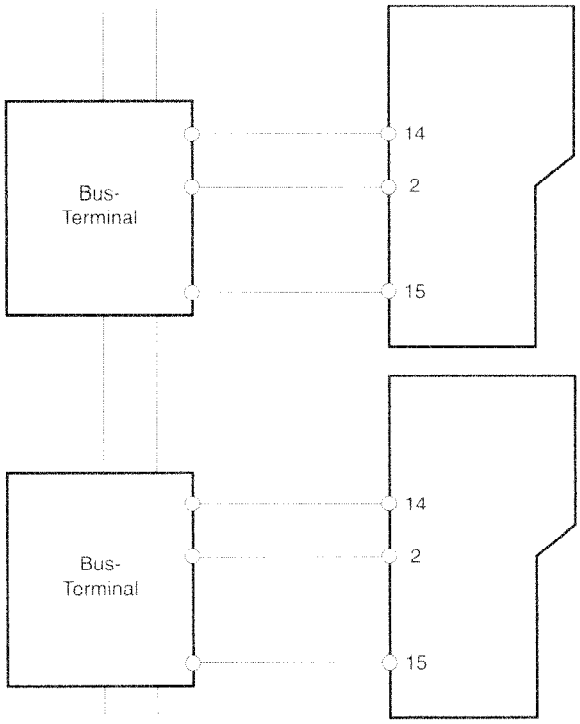


Fig. 25 Connection DDLS – L2 bus via bus terminal

Configuration

- DDLS 78.xx with R-485 interface module
- Bus terminal

8 Installation and commissioning

8.1 Preparation

- Per data transmission path, 2 unit of the same type are required – one unit per side.
- For two parallel data transmission paths with a spacing of less than 2.5 m:
  One data transmission path operated with DDLS 78.6.1 (red light).

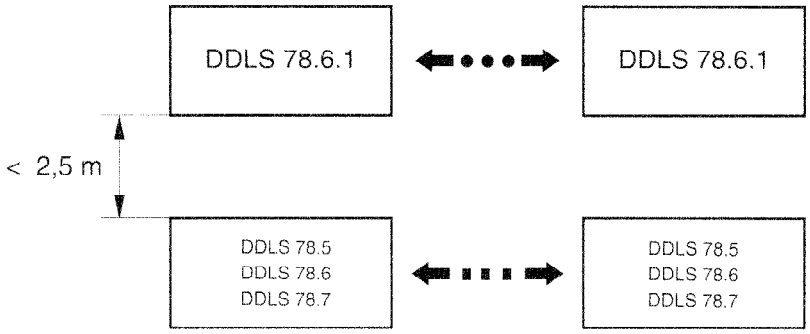


Fig. 26 Application DDLS 78.6.1

- Ensure trouble-free data transmission through
  – free visual contact between transmitter and receiver
  – precise alignment
  – clean lens.
- Ensure correct polarity when installing data conductors.
- Set carrier frequencies for all DDLS.
- Resetting and adjusting interfaces as required.

8.2 Resetting of interfaces

⚠ Incorrect exchange of interface modules leads to unit errors or damage to components. For this reason:

- Avoid electrostatic charging.
- Do not touch plug pins.
- Store interface modules outside the data transmission unit only in their original packaging.

The optical data transmission units DDLS are fitted as standard with a TTY interface. Interface modules (RS-232, RS-422, RS-485) must be mounted and adjusted as follows.

8.3 Integration of interfaces

➜ Remove the unit lid.

➜ Release the fixing screw (1) at the interface module (2) and remove.

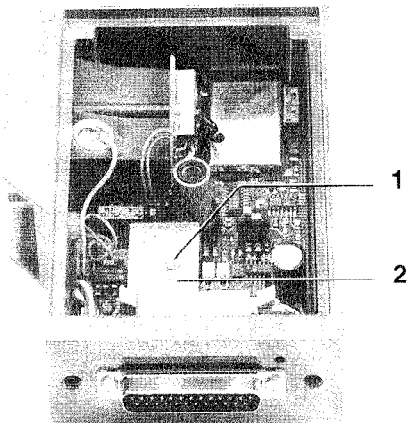


Fig. 27 Interface module

➜ Exchange the interface module.

➜ Set the interface.

8.4 TTY setting

Active/passive

The TTY interface is a 20 mA interface. When coupling two units, one transmitter and one receiver loop are connected. A current of 20 mA is injected into this loop. There are two operating modes (see Fig. 28):

① Active mode: The current is injected at the DDLS at the transmitter and receiver side.

② Passive mode: The current is injected at the computer/PLC side.

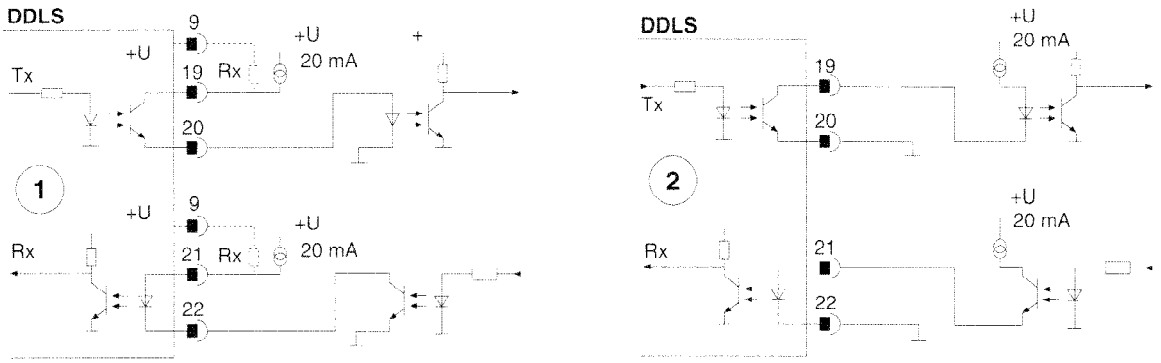


Fig. 28 Active - Passive mode

Active mode (Rx/Tx)

Possibilities to inject the current of 20 mA:

- 20 mA current source
- or via an RX resistor against $+U_B$.

➜ Calculate the resistance value for the resistor:
Use resistors with at least 0.5 W.

$$R_X = U_B/20\ mA$$

➜ Mount one resistor each in every unit between pin 18 - 19 and pin 23 - 21.

➜ Create the current supply. Mount a jumper between pin 9 - 18 and pin 9 - 23.

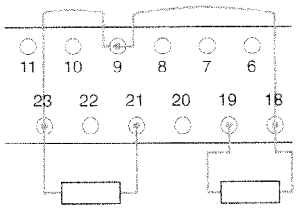


Fig. 29 Resistor circuit

Inverse operation

In TTY operation, current flows when the unit is in the release state. In battery-fed units, this current drains the battery with time.

When using the battery, select the "inverted mode" to prolong the life of the battery.

➜ In both units, switch over the slide switch in the inside of the unit.
The units are set in the factory to the "not inverted" position.

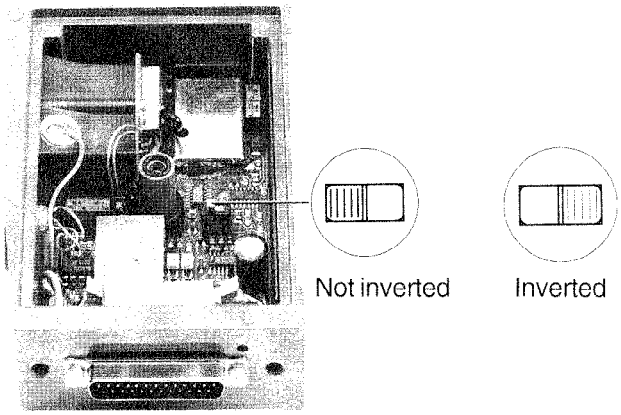


Fig. 30 Slide switch

Transmitter activation

In the TTY interface, the transmitter is continuously activated by the plug-in module.

Alternatively, the transmitter can also be externally activated via pin 11, i.e. for selective shutdown of a data transmission path. The receiver remains active during this process.

Activation of the transmitter by means of an external signal.

➜ Insert a jumper between pin 9 - 11 and pin 10 - 25:

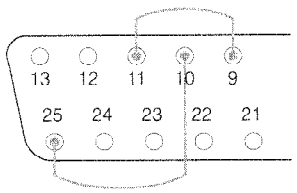


Fig. 31 External transmitter activation

8.5 RS-232 and RS-422 setting

Handshake The handshake mode can be activated with interfaces RS-232 and RS-422 both with and without the terminals CTS and RTS.

Software handshake

Leave the following terminals free.

RS-232 Pin 4 (CTS) and pin 5 (RTS).

RS-422 Pin 4 and 16 (CTS) and pin 5 and 17 (RTS).

Transmitter activation Activation of the transmitter by means of an external signal.

→ Insert a jumper between pin 9 - 11 and pin 10 - 25:

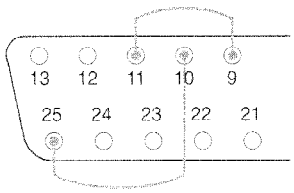


Fig. 32 Handshake

Hardware handshake

Handshake mode with CTS/RTS:

With the CTS signal (clear to send), the transmitter is activated and a request to send (RTS) signal generated at the DDLS positioned opposite.

Do not connect the input for transmit activation at pin 11.

If the optical path is interrupted, the RTS status is "low".

The transmitter can be disabled if required; the receiver operates independently of the activation input status.

In this way

- It is possible to avoid mutual interaction between adjacent data transmission units by selective connection and disconnection,
- Point-by-point suppression of the data transmission is possible

8.6 RS-485 setting

The RS 485 interface is suitable for connection of the DDLS to Profi Bus systems (e.g. SINEC L2 bus).

Users Up to 32 users can be connected per bus segment (bus line).

Transmission rate

In the RS 485 interface, adjust the IDLE time to the transmission rate.

→ Set the IDLE time at the plug-in jumper (1) on the interface module
In the case of transmission rates positioned between the prescribed values on the interface module, select the next lowest value.

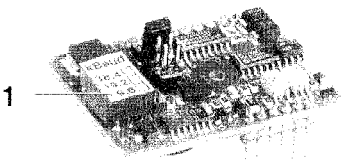


Fig. 33 Setting IDLE time

Bus termination

Output resistance Output resistance (1) of the RS 485 interface module: 2.2 kΩ (see Fig. 35).

Pull-up/pull-down resistors Per bus segment (bus line) insert pull-up and pull-down resistors at one of the users.
Possibilities:

- Terminator; e.g. insertion of resistors via the control system;
- at the DDLS electrically most distant from the master

→ Insert two jumpers each at both units:

- Pin 3 - 14
- Pin 2 - 16

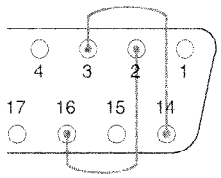


Fig. 34 Bus operation

Terminating resistor With the jumpers, at the same time insert a terminating resistor (2) of 220 Ω into the bus line (see Fig. 35).

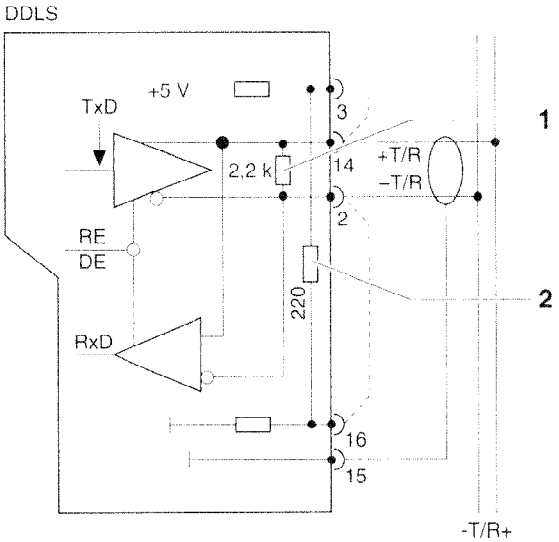


Fig. 35 Terminating resistor

Transmitter activation In the RS-485 interface, the transmitter is permanently activated by the plug-in module.

8.7 Setting and installation

Setting the carrier frequency

Setting the carrier frequency:

- For parallel data transmission paths in accordance with Fig. 36,
- For consecutive data transmission paths in accordance with Fig. 37.

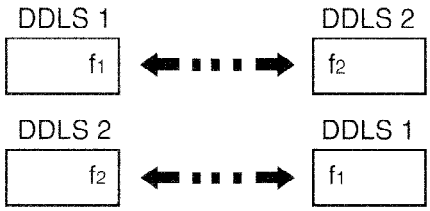


Fig. 36 Parallel mode

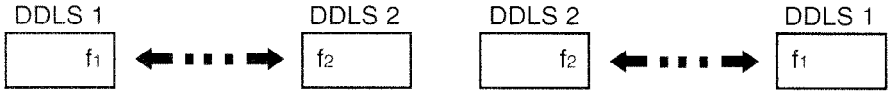


Fig. 37 Consecutive paths

→ Set carrier frequencies at both units:
DDLS 1 frequency 1 (f_1): Jumper pin 8 – pin 10 (GND)
or leave pin 8 open.

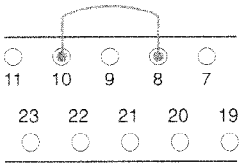


Fig. 38 Setting carrier frequency DDLS 1

DDLS 2 frequency 2 (f_2): Jumper pin 8 – pin 9 ($+U_B$)

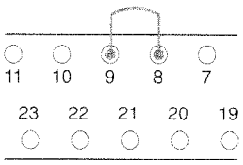


Fig. 39 Setting carrier frequency DDLS 2

8.8 Installation

Mounting of the DDLS is considerably simplified using the mounting bracket (see accessories.
Avoid vertical, horizontal and angular offset between two units.

- ➜ Fasten the mounting and aligning brackets using 4 screws.
- ➜ Screw the DDLS to the mounting and aligning bracket using two screws each.
- ➜ Create the cable connections to the data processing units (computer, PLC etc.)
- ➜ Re-insert the fastening screws and tighten.
- ➜ Mount the unit lid and screw.

8.9 Commissioning

- ➜ Before commissioning, check: Are all cables and connectors correctly connected?
- ➜ Activate the DDLS using the connected control system:

If faults occur during commissioning, or if the data transmission path cannot be activated, see the instructions contained in the chapter on faults and their remedy.

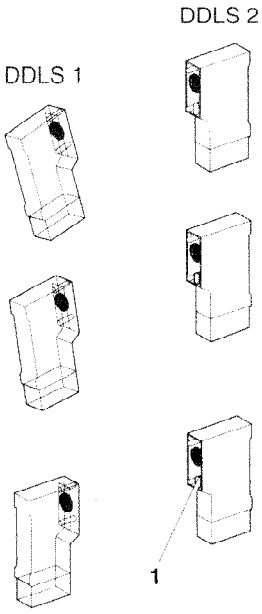
8.10 Alignment

Each DDLS is fitted with a multifunction display (LED) which can be used to help align the unit. The flashing frequency and colour of the LED indicate the quality of the alignment (see Fig. 40).

Alignment with the aid of LED

The DDLS 1 transmits its signal to the DDLS 2. Here, the LED signals the quality of the arriving signal . When adjusting the DDLS 1, observe the LED at the DDLS 2. Continue to adjust the DDLS 1 until the LED at the DDLS 2 lights up yellow.

When using the mounting and aligning bracket, adjust the DDLS using the adjusting nuts.



Multifunction display LED (1)	Data transmission
off	none
flashing red	none
flashing yellow	critical
yellow	good

Fig. 40 Function of the multifunction display

→ Align the DDLS 2 in the same way as the DDLS 1.

Setting for vehicles or moving parts:

→ In vehicles or on moving parts, adjust the DDLS at 2 m and 20 m.

Check: The LEDs at both units must light over the whole path.

Precision adjustment

If the LEDs flash despite adjustment: Carry out precision adjustment with the Voltmeter.

→ Connect the voltmeter to the DDLS 2 (pin 24 and pin 10) and measure the analogue voltage. Continue to adjust the DDLS 1 until the analogue voltage amounts to around 5.8 - 6 V (observe Fig. 41).

→ Then repeat the measurement at the DDLS 2.

Setting for vehicles or moving parts:

→ In vehicles or on moving parts, adjust the DDLS at 2 m and 20 m.

Check: The LEDs at both units must light over the whole path.

Alignment monitoring

To monitor the aligned DDLS warning output, connect pin 13 and fault output pin 12 to a data processing unit (e.g. PC or PLC).

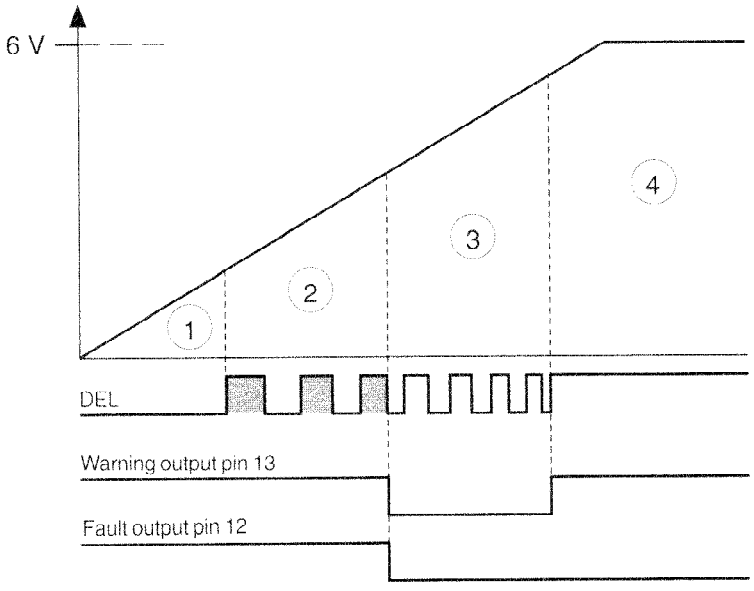


Fig. 41 Alignment of the DDLS

No.	Data transmission	Multifunction display (LED)
1	none	off
2	none	red flashing
3	critical	yellow flashing
4	good	yellow

Alignment with the laser alignment aid

Use the laser alignment aid
- in case of fluctuations in the track guidance of the vehicle
- in case of tolerances in the rail guidance

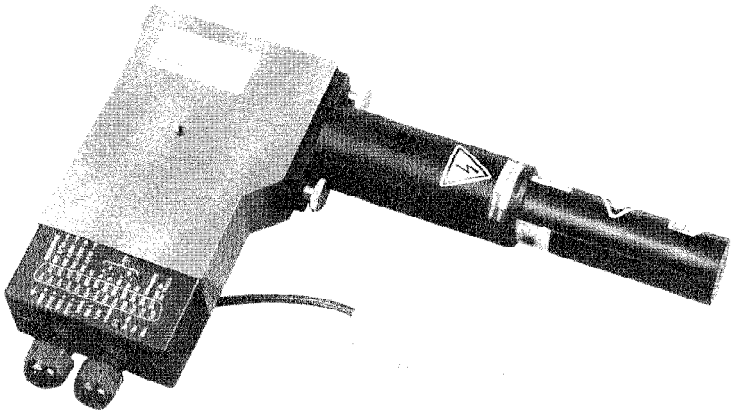


Fig. 42 DDLS with laser alignment aid

Laser beams can cause eye injuries. For this reason:

⚠
- Before switching on the laser, ensure that there is no-one looking directly into the laser;
- Do not look into the laser;
- Do not direct the laser at reflecting surfaces or at people.

➜ Fix the alignment aid to the bolt of a DDLS.

➜ Put the laser into operation.

➜ Hinge open the protective flap over the laser.

➜ Align the laser beam (red dot) with the aid of the adjusting nuts onto the receiver of the opposite DDLS.
Observe the migration of the light spot along the entire travel path.

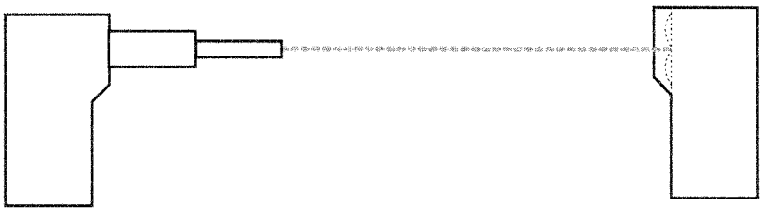


Fig. 43 Application of the laser alignment aid.

➜ Align the second DDLS in the same way as the first DDLS

➜ Close the outlet opening by shutting the flap over the laser again.

9 Maintenance

The DDLS is maintenance-free.
Clean the transmitter and receiver of the DDLS at regular intervals, using a soft cloth and cleaning agent (commercially available glass cleaning agent).

Check the alignment of the DDLS at regular intervals, and readjust the DDLS as required.

10 Faults and their remedy

Fault	Possible cause	Remedy
Transmission fault	Interaction by parallel data paths	Check minimum distance between data transmission paths 2.5 m. With 2 duplex paths next to each other, use IR and red light DDLS
	Interaction by data paths installed consecutively	Check carrier frequencies: Path 1: $f_1 \leftrightarrow f_2$ Path 2: $f_2 \leftrightarrow f_1$
	Shielding defective	Check shielding
	Power supply earth has connection to housing; possible electromagnetic interference	Separate power supply earth from housing: Mount DDLS in isolation
LED flashes yellow or red or is off, no data transmission	Transmitter or receiver lens dirty	Clean lens
	Alignment of optical axes is not correct: • Data transmission error in certain areas of the transmission path due to angular offset • Performance reserve quickly reached over data transmission path due to horizontal or vertical offset	• Check visual alignment: Angular, vertical, horizontal offset • Check voltage at the measurement output (pin 24) over the whole path (appr. 6 V) • Using laser alignment aid, check light spot migration over whole travel path

Fault	Possible cause	Remedy
LED off, no data transmission	Carrier frequencies f_1/f_2 not set	Check jumpers at the DDLS. DDLS 1: f_1 → pin 8 - 10 (GND) or pin 8 open DDLS 2: f_2 → pin 8 - 9 (U_B)
	Signal lead interrupted, terminals defective	Check signal leads and terminals
	No transmitter activation	Check jumpers TTY: Pin 11 - 9 (U_B) (Factory set using inserted activation card) RS-232/RS-422: PIN 11 - 9 (U_B) RS-485: Activated via interface card
	Point-to-point connection TTY:	
	• Slide switches for phase position (inverted / not inverted) set differently	• Set slide switches for phase position inside the DDLS in a uniform position
	• No 20 mA current injection	• Check terminals and jumpers for 20 mA current injection
	• In active operation, no external resistor	• Mount resistor
	RS-232/RS-422: Transmitter activation and RTS/CTS signals used at the same time	Clarify which type of transmitter activation is required
	RS-485: IDLE time not coordinated	After receipt of the signal min. 11 bit waiting time until system switches to transmit; Check IDLE time (dependent on Baud rate)
	Bus operation	
	• L1 bus with TTY: Connection to BT 777 faulty	• Connection to BT 777 and 20 mA, check injection
	• Bus conductor faulty	• Check bus conductor
	L2 bus with RS-485: • RS-485 plug-in modules defective or missing	• Check RS-485 plug-in modules
	• IDLE time not coordinated	• In semi-duplex operation after receipt of signal min. 11 bit waiting time until system switches to transmit. Check IDLE time (dependent on baud rate)
	• Pull-up/pull-down resistors not triggered	• Check jumpers: Pin 3 - pin 14 Pin 2 - pin 16
	• Faulty shielding	• Check shielding

11 Accessories and order designations

Two DDLS of the same type are required per data transmission path.
The TTY interface is integrated in every unit type.
Specify when ordering:

- DDLS type (1)
- Interface module (apart from TTY) (2)
- Terminal type (3)

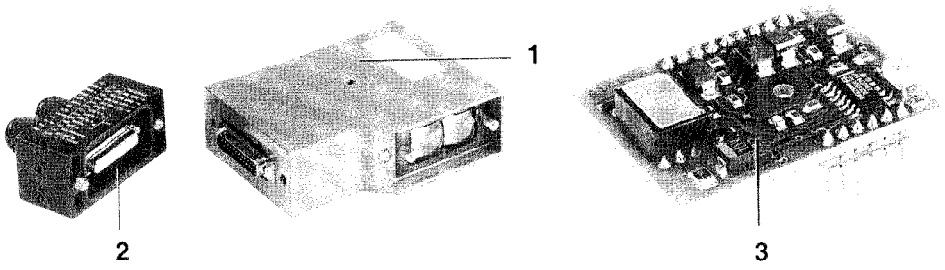
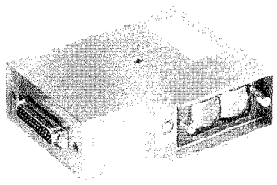


Fig. 44 DDLS components

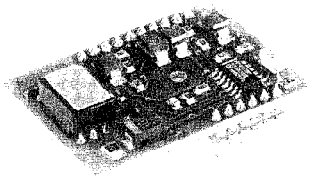
Basic units

Data transmission units with integrated TTY/20 mA interface



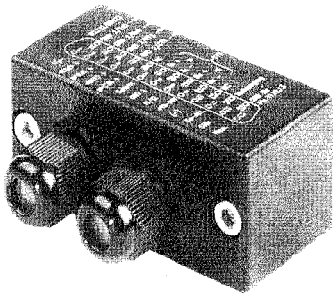
Description		Type/order designation
Range	Transmission	
120 m	9600 bits/s	DDLS 78.5
200 m	19200 bits/s	DDLS 78.6
120 m red light	19200 bits/s	DDLS 78.6.1
200 m	38400 bits/s	DDLS 78.7

Interface modules

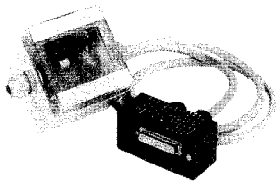
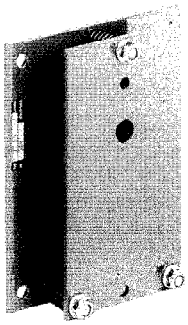


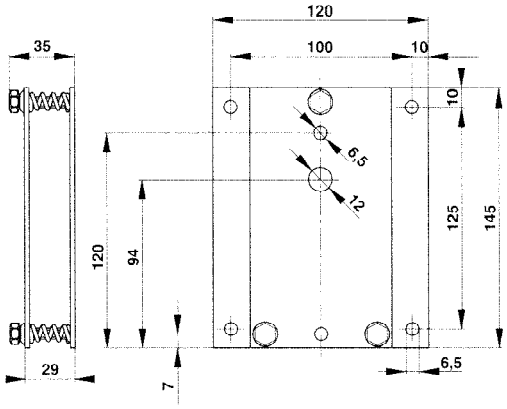
Plug-in module RS-232	IM 01-RS-232
Plug-in module RS-422	IM 01-RS-422
Plug-in module RS-485	IM 01-RS-485

Connection elements

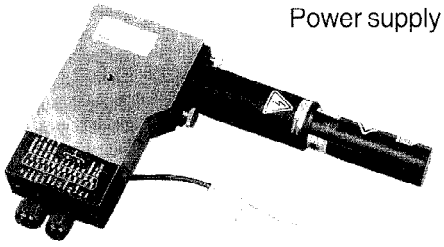


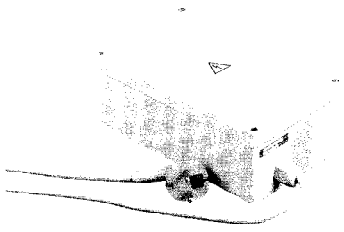
Connection element with Sub-D socket 25-pole for soldered connection cable entry 2 x PG 9	AT 78-01
Connection element with Sub-D socket 25-pole with screw-type terminals cable entry 2 x PG 9	AT 78-02

	Description	Type/order designation
	Terminal unit (only suitable for TTY/20mA interface with additional display function) consisting of: • Sub-D socket 25-pole (as AT 78-01) • Terminal box with display functions for data cables, transmission frequency f_1/f_2, screw-type terminals for cable connection, changeover switch for transmission frequency f_1/f_2, • Cable length 500 mm	AT 78-03
Mechanical fixture		
	Mounting and adjusting bracket for all DDLS 78.5 ... 7 units for fixture and precise alignment	BT 16

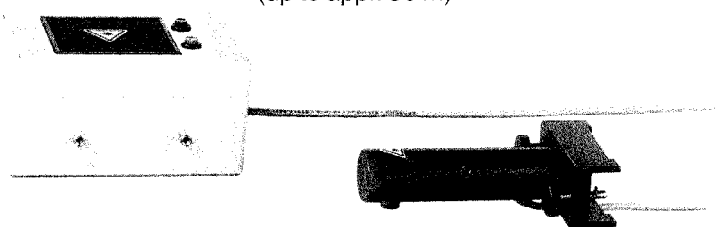


Laser alignment aid	Laser tube for mains operation	ARH 5
	Power supply unit for ARH 5	NT 18





	Laser tube with battery operation (up to appr. 50 m)	ARH 2



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