User manual

UM EN PSI-MODEM-SHDSL/SERIAL

Order No.: —

SHDSL SERIAL permanent line modem, for point-to-point, line, and star structures on in-house cables

PHŒNIX CONTACT

INSPIRING INNOVATIONS

User manual

SHDSL SERIAL permanent line modem, for point-to-point, line, and star structures on in-house cables

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Designation:	UM EN PSI-MODEM-SHDSL/SERIAL
Revision:	c00
Order No.:	—

This user manual is valid for:

Designation	Revision	Order No.
PSI-MODEMSHDSL/SERIAL		2313669

Please observe the following notes

User group of this manual

The use of products described in this manual is oriented exclusively to:

– Qualified electricians or persons instructed by them, who are familiar with applicable standards and other regulations regarding electrical engineering and, in particular, the relevant safety concepts.

– Qualified application programmers and software engineers, who are familiar with the safety concepts of automation technology and applicable standards.

Explanation of symbols used and signal words

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety measures that follow this symbol to avoid possible injury or death.

There are three different categories of personal injury that are indicated with a signal word.

DANGER This indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING This indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION This indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

This symbol together with the signal word **NOTE** and the accompanying text alert the reader to a situation which may cause damage or malfunction to the device, hardware/software, or surrounding property.

This symbol and the accompanying text provide the reader with additional information or refer to detailed sources of information.

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1 Description of the SHDSL permanent line modem

1.1 Description

The industrial SHDSL SERIAL permanent line modem enables broadband networking of serial devices via in-house cables.

Areas of application

– Suitable for in-house cables, not for public telephone networks
– Point-to-point connection
– Star structure
– Line structure (daisy chain)

SHDSL technology

– Symmetrical data transmission
– 2 SHDSL ports per device
– Up to 30 Mbps (4-wire)
– Up to 15.3 Mbps (2-wire)

RS-232 interface (9-pos. D-SUB)

– Transparent protocol
– Automatic DCE/DTE switchover
– RS-232, up to 230.4 kbps

RS-485 W2/RS-422 interface (COMBICON plug)

– Transparent protocol
– RS-422, up to 2000 kbps
– RS-485 W2, up to 2000 kbps
– RS-485 W2: termination resistor, can be enabled/disabled

Alarm outputs

– Two digital outputs
– Can be configured individually

Configuration

– With configuration software

The configuration software also supports

– Online diagnostics
– Individual device configuration
– Guided project configuration
– Log book function
– Saving and printing of project and device configurations

1.2 Ordering data

Modem

Description		Type	Order No.	Pcs. / Pkt.
SHDSL permanent line modem, for point-to-point, line, and star structures on in-house 2 and 4-wire cables		PSI-MODEMSHDSL/SERIAL	2313669	1

Accessories

Description		Type	Order No.	Pcs. / Pkt.
System power supply unit, primary-switched Input voltage range Nominal output voltage Nominal output current	45 Hz ... 65 Hz 85 V AC ... 264 V AC 24 V DC ±1% 1.5 A	MINI-SYS-PS-100-240AC/24DC/1.5	2866983	1
DIN rail connector (2 required)		ME 17,5 TBUS 1,5/ 5-ST-3,81 GN	2709561	1
RJ45 (RJ12/RJ11) attachment plug with surge protection for analog tele-communications interfaces. Can alternatively be snapped onto DIN rails.		DT-TELE-RJ45	2882925	1
USB cable, USB type A/mini-USB type B, 5-pos., 1 m long		PSI-CA-USB A/MINI B/1METER	2313575	1 m
USB cable, USB type A/mini-USB type B, 5-pos., 3 m long		CABLE-USB/MINI-USB-3,0M	2986135	3 m
RS-232 cable, for connecting the modem to a 9-pos. device interface, 2 m long	9-pos. D-SUB/9-pos. D-SUB (socket/socket)	PSM-KA9SUB9/BB/2METER	2799474	2 m
RS-232 cable, for connecting the modem to a 9-pos. device interface, 0.5 m long	9-pos. D-SUB/9-pos. D-SUB (socket/socket)	PSM-KA9SUB9/BB/0,5METER	2708520	0.5 m
Adapter cable for connecting the IB IL RS232 and IB IL RS232-PRO Inline communication terminals to an interface converter, e.g., modem, COM server, Bluetooth or fiber optics		PSM-KAD-IL RS232/9SUB/B/0,8M	2319200	0.8 m

1.3 Technical data

Supply	
Supply voltage	18 V DC ... 30 V DC via plug-in COMBICON screw terminal block
	24 V DC ±5% (alternative or redundant, via DIN rail connector and system power supply)
	5 V DC (configuration only, via mini-USB type B)
Nominal current consumption	< 180 mA at 24 V
LED indicator	VCC (green LED) – Steady light: operation – Flashing at 1 Hz: supply via USB (for configuration)
Switching outputs	2 x U_{Nom}/150 mA (the digital outputs cannot be used for power supply via the DIN rail connector), short-circuit-proof

SHDSL interface	
Connection method	2 x 2-pos. COMBICON plug-in screw terminal block
Type	SHDSL interface according to ITU-T G.991.2.bis
Transmission speed	
4-wire operation	64 kbps ... 30 Mbps (manual setting of the data rate)
	384 kbps ... 11.39 Mbps (automatic detection of the data rate)
2-wire operation	32 kbps ... 15.3 Mbps (manual setting of the data rate)
	192 kbps ... 5.696 Mbps (automatic detection of the data rate)
Transmission length	Over 20 km possible at lower data rates and with good cable quality
Connection data (conductor cross section)	0.2 mm² ... 2.5 mm² (24 - 14 AWG)

SHDSL interface

Status and diagnostic indicators	2 x LINK, 2 x STAT (DSL data traffic port A and port B)
	DIAG (yellow LED), diagnostic messages
	ERR (red LED), errors
	TERM (yellow LED), only relevant for RS-485
	RS232 (yellow LED)

RS-232 interface

Connection method	9-pos. D-SUB plug
Type	RS-232 interface, according to ITU-T V.28, EIA/TIA-232, DIN 66259-1
Transmission speed	Can be freely parameterized from 92 bps ... 230.4 kbps
Transmission length	15 m, maximum
Supported protocols	Software handshake (Xon/Xoff), hardware handshake (RTS/CTS), 3964R-compatible, Modbus RTU/ASCII, transparent protocol - other protocols supported
Data format/encoding	Serial asynchronous UART/NRZ, 7/8 data bits, 1/2 stop bits, 1 parity bit (even, odd, mark, space, none), 9/10/11-bit character length

RS-422 interface

Connection method	Plug-in and screw connection via COMBICON plug
Type	RS-422 interface, according to ITU-T V.11, EIA/TIA-422, DIN 66348-1
Transmission speed	Can be freely parameterized from 92 bps ... 2 Mbps
Transmission length	1200 m, maximum
Supported protocols	Modbus RTU/ASCII and others, transparent protocol
Data format/encoding	Serial asynchronous UART/NRZ, 7/8 data bits, 1/2 stop bits, 1 parity bit (even, odd, mark, space, none), 9/10/11-bit character length

RS-485 interface

Connection method	Plug-in and screw connection via COMBICON plug
Type	RS-485 interface, according to EIA/TIA-485, DIN 66259-4/RS-485 2-wire
Transmission speed	Can be freely parameterized from 92 bps ... 2 Mbps
Transmission length	1200 m, maximum
Supported protocols	Modbus RTU/ASCII and others, transparent protocol
Data format/encoding	Serial asynchronous UART/NRZ, 7/8 data bits, 1/2 stop bits, 1 parity bit (even, odd, mark, space, none), 9/10/11-bit character length

USB interface (configuration/diagnostics)

Connection method	Mini-USB type B, 5-pos.
Type	USB 2.0
Transmission length	5 m, maximum, only for configuration and diagnostics

General data

|	
Ambient temperature range	
Operation (no other modules supplied via the device):	
– Freestanding (40 mm spacing)	-20°C ... +60°C
– Connected in series (low power dissipation of modules connected in series)	-20°C ... +55°C
– Connected in series (without restrictions)	-20°C ... +50°C
Operation (other modules supplied via the device (1.5 A, maximum))	-20°C ... +45°C
Storage/transport	-40°C ... +85°C
Housing	ME 35 with 5-pos. bus contact and ground contact
Material	PA 6.6-FR, V0, green
Dimensions (H x W x D)	99 x 35 x 114.5 mm
Weight	205 g
Functional earth ground	Housing contact to DIN rail
Degree of protection	IP20

General data (Fortsetzung)

Electrical isolation	DIN EN 50178 (Supply // RS-485, RS-422 // DSL port A // DSL port B // FE)
MTBF according to Telcordia standard	– 1004 years Telcordia standard, 25°C ambient temperature, 21% operating cycles (5 days a week, 8 hours a day) – 199 years Telcordia standard, 40°C ambient temperature, 34.25% operating cycles (5 days a week, 8 hours a day)
Test voltage	1.5 kV AC, 50 Hz, 1 min.
Vibration resistance	According to IEC 60068-2-6: 5g, 150 Hz
Shock resistance	15g in each space direction, according to IEC 60068-2-27
Noise emission	EN 55011
Noise immunity	EN 61000-6-2
Electromagnetic compatibility	Conformance with EMC Directive 2004/108/EC
UL, USA/Canada	UL 508 listed in preparation
Manufacturer's declaration	EN 50121-4 (Railway applications - Electromagnetic compatibility, Part 4: Emission and immunity of the signaling and telecommunications apparatus)
	Exceptions include installations within the 3 m area and safety-related devices. For these devices, there are further requirements according to EN 50121-4 Table 1, Note 1.
	Section 1, Paragraph 3 of EN 50121-4 applies. Phoenix Contact QUINT power supply units are to be used directly on the device.
Conformity assessment according to directive 94/9/EC	⟨Ex⟩ II 3 G Ex nAC IIC T4 X

Housing dimensions
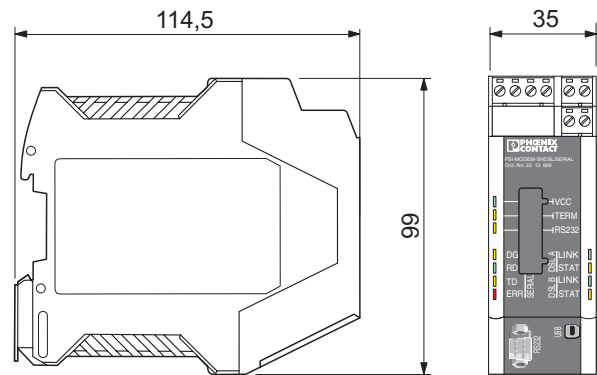
Figure 1-1   Housing dimensions (in mm)

104275A001

1.4   SHDSL technology

SHDSL (Symmetrical High-Speed Digital Subscriber Line) enables the same data transmission speeds for up and downstream via one or two double wires.

Data rates of up to 15.3 Mbps are possible per cable pair.

i | The maximum possible transmission speed greatly depends on the cable length, the cable cross section, and the cable type.
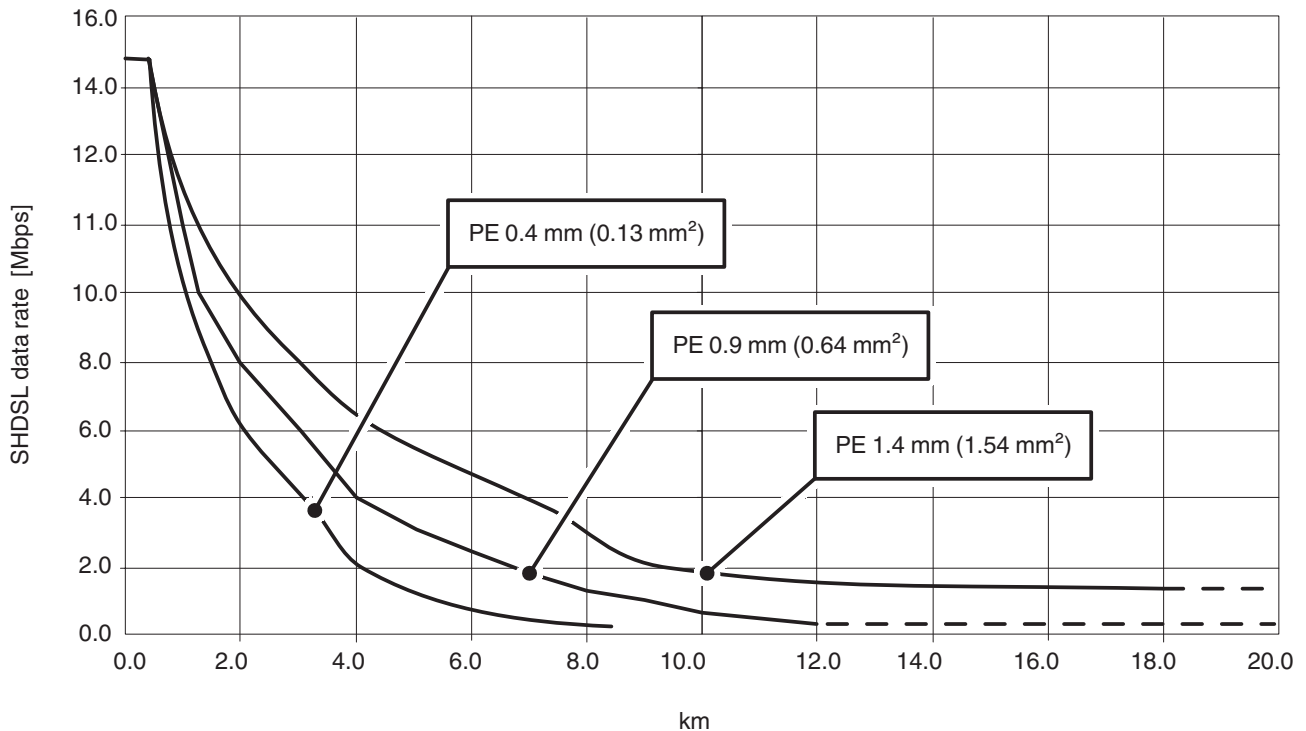
Figure 1   Dependency of the maximum SHDSL data rate (Mbps) on the line length for a 2-wire connection

Figure 1 illustrates the dependency of the maximum data rate on the line length with three cable types. Higher data rates or longer distances can be achieved when high-quality cables with larger diameters are used.

Industrial SHDSL permanent line modems from Phoenix Contact support data rates of 32 kbps to 15.3 Mbps in 2-wire operation and data rates of up to 30 Mbps in 4-wire operation.

SHDSL permanent line modems are suitable for in-house cables, not for public telephone networks.

1.5   Interface basics

1.5.1   RS-232

The RS-232 interface is a widely used serial interface, which is defined in standards EIA-232 and CCITT V.24.

This interface carries out data exchange between two devices (point-to-point connection). It transmits and receives data in full duplex mode over lines of up to 15 m. The maximum transmission speed is 230.4 kbps.

In the simplest configuration, three cables are required:

–   TxD (transmit data)

–   RxD (receive data)

–   GND (common signal ground)

For more complex data transmission with hardware handshake, additional control and signal lines are required.

The RS-232 interfaces of devices can be designed as data communication equipment (DCE) or data terminal equipment (DTE). In the case of a DTE device, data is transmitted via the TxD connection, whereas a DCE device receives data via this connection.

A DTE device can be connected to a DCE device via a linear connection. When connecting two devices of the same type (DTE/DTE or DCE/DCE), all cables must be crossed.

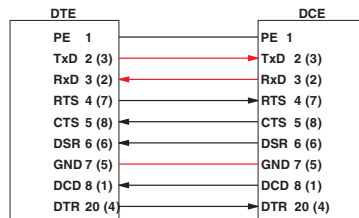The SHDSL modem supports automatic switchover between DTE/DCE (see "Connecting the serial interface" on page 2-9).

```
        DTE                        DCE
   PE    1                    PE   1
   TxD   2 (3)                TxD  2 (3)
   RxD   3 (2)                RxD  3 (2)
   RTS   4 (7)                RTS  4 (7)
   CTS   5 (8)                CTS  5 (8)
   DSR   6 (6)                DSR  6 (6)
   GND   7 (5)                GND  7 (5)
   DCD   8 (1)                DCD  8 (1)
   DTR  20 (4)                DTR 20 (4)
```

Figure 1-2   Pin assignment of the RS-232 interface for 25-pos. D-SUB (9-pos. D-SUB)

The signal level is defined as follows:

Data cables	-3 V ... -15 V for logic "1"
	+3 V ... +15 V for logic "0"
Control/signal lines	-3 V ... -15 V for logic "0"
	+3 V ... +15 V for logic "1"

Properties of RS-232		
Standards	ITU-T V.24/DIN 66020-1, ITU-T V.28/DIN 66259-1, TIA/EIA-232	
Transmission speed	230.4 kbps, maximum	
Transmission length	15 m, max. (RS-232)	For industrial applications, we recommend reducing the distance to 5 m at a high transfer speed.
Method	Voltage interface	
Principle	Full duplex, point-to-point, no multipoint connection	

1.5.2   RS-422

The RS-422 standard supports serial data transmission in full duplex mode between two devices. In the case of the RS-422 interface, data can travel distances of up to 1200 m. Transmission speeds of up to 2000 kbps are possible.

The RS-422 interface is operated with at least two data channels: transmit (T) and receive (R).
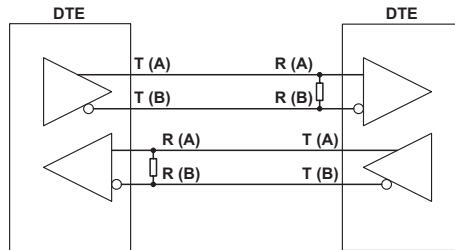

Figure 1-3   RS-422 interface

Termination resistors (100 ... 200 ohms) are provided at the inputs of the receiver.   These resistors prevent reflections on the transmission cable and increase transmission reliability.

In addition, to ensure reliable transmission the differential mode voltage between twisted wire pairs is evaluated. Interference voltages in relation to ground are not taken into consideration.

The signal level is defined as follows:

Data cables	-0.3 V to -6 V for logic "1"	The signal status is indicated
	+0.3 V to +6 V for logic "0"	by the voltage between measuring points (A) and (B).

Properties of RS-422	
Standards	ITU-T V.11/DIN 66259-3, TIA/EIA-422
Transmission speed	2000 kbps, maximum
Transmission length	1200 m, maximum (on the RS-422 side)
Method	Voltage difference, twisted pair
Principle	Full duplex, point-to-point, no multipoint connection

 For additional information, please refer to "Connecting the serial interface" on page 2-9.

1.5.3 RS-485 W2

The RS-485 W2 interface is similar to the RS-422 interface. The electrical levels and their logical assignment are identical to those of the RS-422 standard. In addition, the RS-485 W2 interface offers the option of multipoint connections.

In the case of a multipoint connection, all devices are addressed and identified via a single address. Only one device may transmit at any given moment, all other devices are in "listening mode".

In the case of the RS-485 W2 interface, W2 stands for 2-wire technology. Data transmission is based on the half duplex method, where data is alternately transmitted and received.
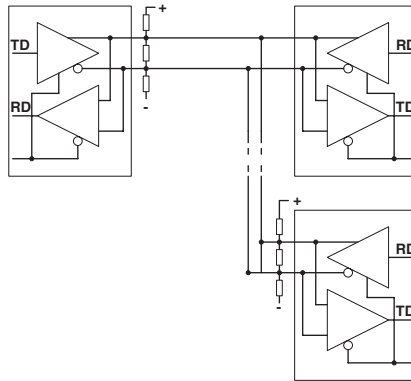

Figure 1-4   RS-485 W2

The 2-wire bus cable can be up to 1200 m long. It must be terminated at both ends by a termination resistor (100 ... 200 ohms). The individual devices can be located away from the bus cable using branch lines. The length of the branch lines depends on the data rate. We recommend that the branch lines used are as short as possible.

The transmission speed is up to 2000 kbps when using a twisted pair shielded data cable.

The RS-485 standard only describes the physical properties. RS-485 interfaces are not necessarily compatible with one another. Additional parameters such as transmission speed, data format, and data encoding are defined in system standards such as PROFIBUS or Modbus.

Properties of RS-485 W2	
Standards	ISO/IEC 8482/DIN 66259-4, TIA/EIA-485 (draft)
Transmission speed	2000 kbps, maximum
Transmission length	Depends on the data rate
Method	Voltage difference, twisted pair
Principle	Half duplex, multipoint

i	For additional information, please refer to "Connecting the serial interface" on page 2-9.

1.6 Supported network structures

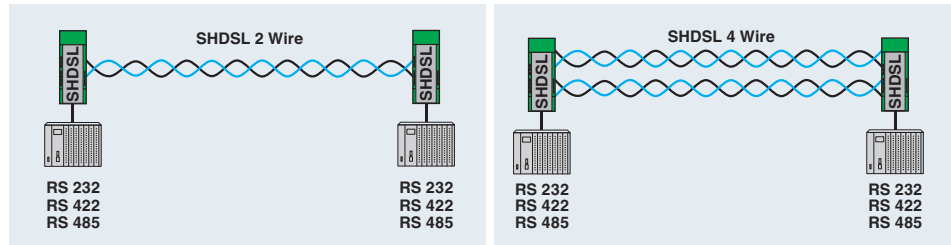## 1.6.1 Point-to-point connection

Figure 1-5   Point-to-point connection

A point-to-point connection is a direct connection between two devices without an intermediate station.

Distances of over 20 km can be covered at low data rates and with good cable quality.

In principle, the following interfaces can be used for a point-to-point connection:

– RS-232, up to 230.4 kbps
– RS-422, up to 2000 kbps
– RS-485 W2, up to 2000 kbps

> **i** In mixed operation with an RS-232 device and an RS-422 or RS-485 device, hardware or software handshake is not supported.
>
> In the case of RS-422 and RS-485, there are no cables designed for hardware handshake. This is therefore not supported.
>
> There is no defined general software handshake for all three interfaces. This is therefore not supported either.

> **i** You can implement a point-to-point connection in which full and half duplex interfaces are used (e.g., RS-485 and RS-232/RS-422). In this case, however, the protocol must ensure that all interfaces are operated in half duplex mode.

> **i** In an RS-422 configuration (point-to-point connection), all termination resistors are activated automatically via the software.
>
> In an RS-485 W2 configuration, the termination resistor can be enabled and disabled via the PSI-CONF configuration software.

Table 1-1   Information on the interfaces

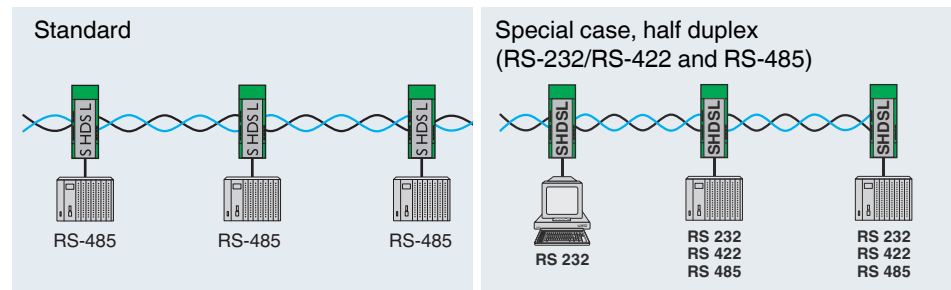|	Interface basics	Connection to the SHDSL modem (connector pin assignment)
RS-232	See "RS-232" on page 1-6	See "RS-232 interface" on page 2-10
RS-422	See "RS-422" on page 1-7	See "RS-485 W2/RS-422 interface" on page 2-11
RS-485 W2	See "RS-485 W2" on page 1-8	

1.6.2 Line structure (daisy chain)

Figure 1-6   Line structure

A line structure (daisy chain) is a number of components that are connected in series. Using the permanent line modem, up to 255 devices can be connected together in 2-wire operation.

Distances of over 20 km can be covered at low data rates and with good cable quality.

> **i** You can implement a line structure in which full and half duplex interfaces are used (e.g., RS-485 and RS-232/RS-422). In this case, however, the protocol must ensure that all interfaces are operated in half duplex mode.

> **i** If a line structure is created with just full duplex-compatible interfaces (RS-232, RS-422), the protocol must ensure half duplex mode.
>
> RS-232 and RS-422 interfaces are usually designed for a point-to-point connection and not a line structure.

> **i** In mixed operation with an RS-232 device and an RS-422 or RS-485 device, hardware or software handshake is not supported.
>
> In the case of RS-422 and RS-485, there are no cables designed for hardware handshake. This is therefore not supported.
>
> There is no defined general software handshake for RS-232, RS-422, and RS-485. This is therefore not supported either.

Table 1-2   Information on the interfaces

	Interface basics	**Connection to the SHDSL modem (connector pin assignment)**
RS-232	See "RS-232" on page 1-6	See "RS-232 interface" on page 2-10
RS-422	See "RS-422" on page 1-7	See "RS-485 W2/RS-422 interface" on page 2-11
RS-485 W2	See "RS-485 W2" on page 1-8	

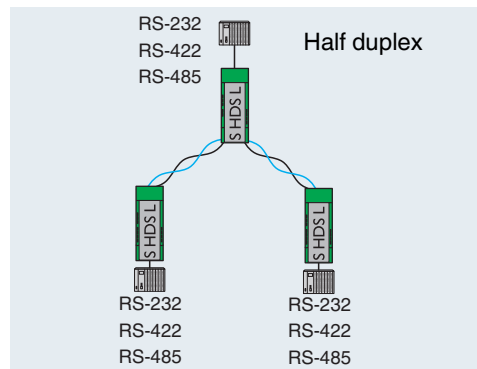### 1.6.3 Star structure (for all interfaces)

Figure 1-7   Star structure (RS-232, RS-422, RS-485)

The star structure in the example (Figure 1-7) consists of three modems. It is a line structure where the middle modem has been moved up to act as the head station. This means that two SHDSL ports are available at each modem.

> **i** In mixed operation with an RS-232 device and an RS-422 or RS-485 device, hardware or software handshake is not supported.
>
> In the case of RS-422 and RS-485, there are no cables designed for hardware handshake. This is therefore not supported.
>
> There is no defined general software handshake for RS-232, RS-422, and RS-485. This is therefore not supported either.

> **i** You can implement a line structure in which full and half duplex interfaces are used (e.g., RS-485 and RS-232/RS-422). In this case, however, the protocol must ensure that all interfaces are operated in half duplex mode.

> **i** If a line structure is created with just full duplex-compatible interfaces (RS-232, RS-422), the protocol must ensure half duplex mode.
>
> RS-232 and RS-422 interfaces are usually designed for a point-to-point connection and not a line structure.

Table 1-3   Information on the interfaces

	Interface basics	Connection to the SHDSL modem (connector pin assignment)
RS-232	See "RS-232" on page 1-6	See "RS-232 interface" on page 2-10
RS-422	See "RS-422" on page 1-7	See "RS-485 W2/RS-422 interface" on page 2-11
RS-485 W2	See "RS-485 W2" on page 1-8	

1.6.4   Star structure via DIN rail connector and RS-485 interface

> **i** In principle, a star structure via the DIN rail connector can only be used in combination with the RS-485 interface.

> **i** Make sure that **all devices connected via the DIN rail connector (T-BUS) use the same serial data rates**.
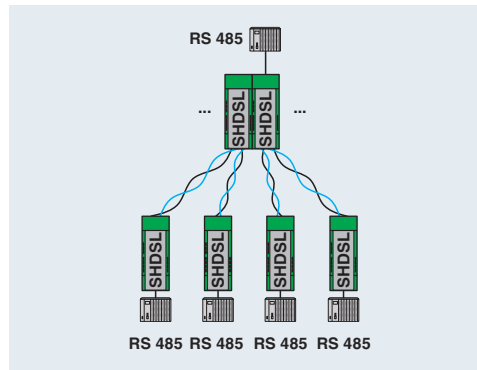

Figure 1-8   Star structure, RS-485

The devices are connected via the DIN rail connector (T-BUS) in the head station.

The DIN rail connector supports RS-485. It can not be used with RS-232 and RS-422.

In order to configure a star structure, you must create several line structures.

In the example, you need to create two line structures, each consisting of three devices.
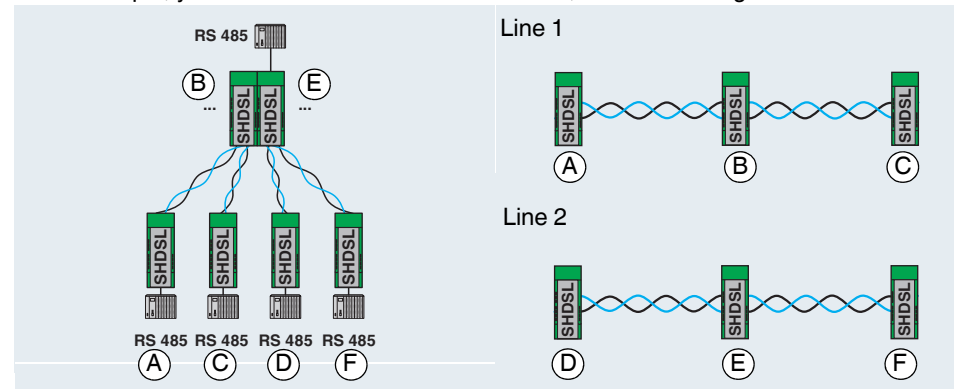

Figure 1-9   Example for a star structure (RS-485 interface on all devices)
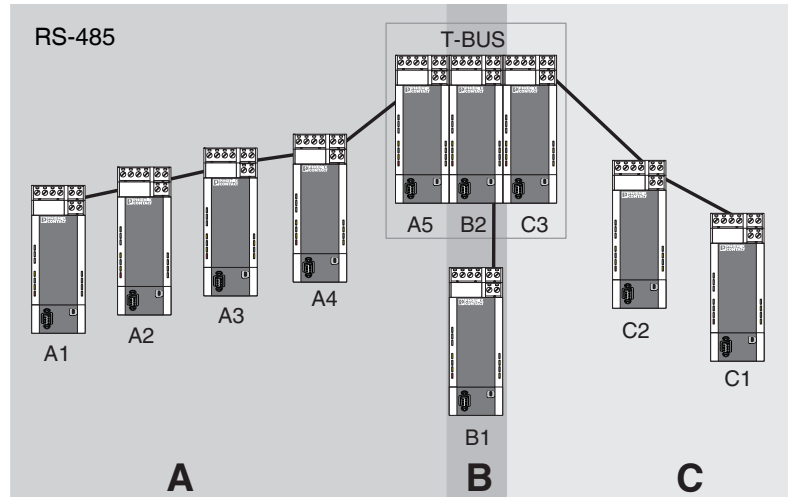
Figure 1-10   Star structure with SHDSL devices (1), RS-485 on all devices

In order to configure the above structure, you must proceed as follows:
- Divide the overall structure into several lines (sections A, B, C)
- Configure each line individually via the PSI-CONF configuration software.

  We recommend beginning with the critical line. These, for example, are long lines with many devices and small cable diameters.
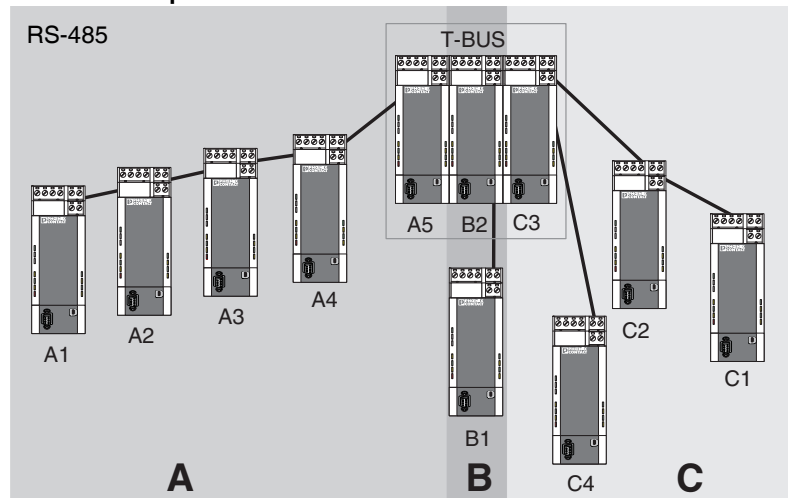
Another example

Figure 1-11   Star structure with SHDSL devices (2), RS-485 on all devices

In this example the termination device for line C is not in the head station. The sequence is the same as above (see Figure 1-10 on page 1-13).

Structure of a head station

For the star structure, individual line structures are coupled together via a head station. In both examples above, devices A5, B2, and C3 are connected via a DIN rail connector (T-BUS).

ℹ️ For a head station, we recommend connecting devices via the T-BUS. In this way, the segments are electrically isolated.
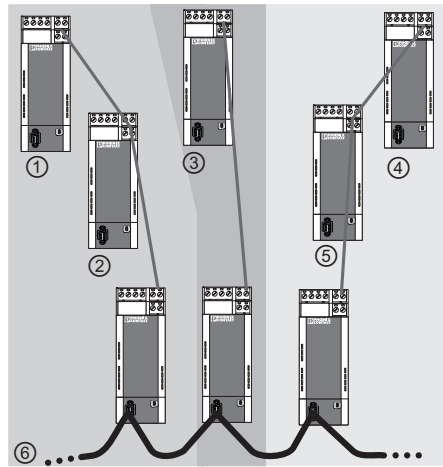
Not recommended (RS-485)   Recommended (RS-485)
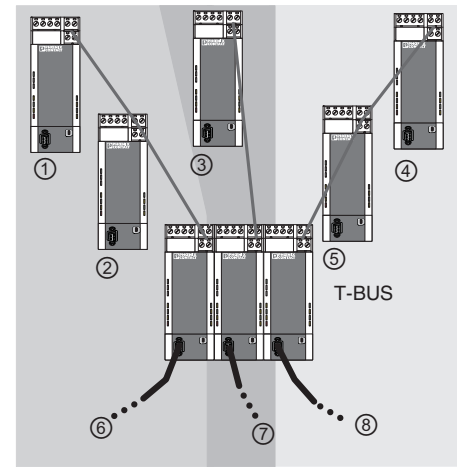
Figure 1-12   Examples for RS-485 head stations

Key

①, ②, ③ ... Segments

1.6.5 Star structure with other RS-485 components

When using an RS-485 interface, the data is transmitted to the DIN rail connector (T-BUS). In this way it is possible to combine the SHDSL modems with other RS-485 components from Phoenix Contact.

> **i** A combination of several different SHDSL modems (e.g., from PSI-MODEMSHDSL/SERIAL and PSI-MODEM-SHDSL/ETH) is not possible.

Supported RS-485 components:

– Modular repeater for electrical isolation and increasing the range for RS-485 (PSI-REP-RS485W2, Order No. 2313096)
– FO converters:
  PSI-MOS-RS485W2/FO 660 T, Order No. 2708300
  PSI-MOS-RS485W2/FO 660 E, Order No. 2708313
  PSI-MOS-RS485W2/FO 850 T, Order No. 2708326
  PSI-MOS-RS485W2/FO 850 E, Order No. 2708339
  PSI-MOS-RS485W2/FO1300 E, Order No. 2708562
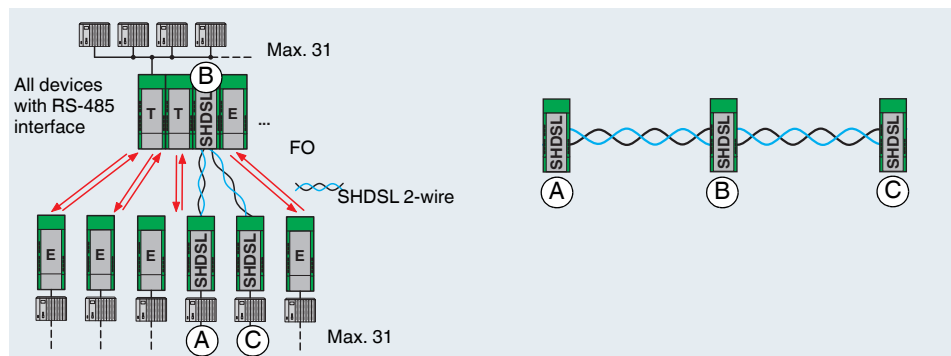
Figure 1-13   Example for a mixed structure (RS-485 interface)

The SHDSL modems are configured via the software as a line structure with three devices, for example. When using a DIN rail connector, all devices must use the RS-485 interface.

Mixed operation of copper cables and fiber optics
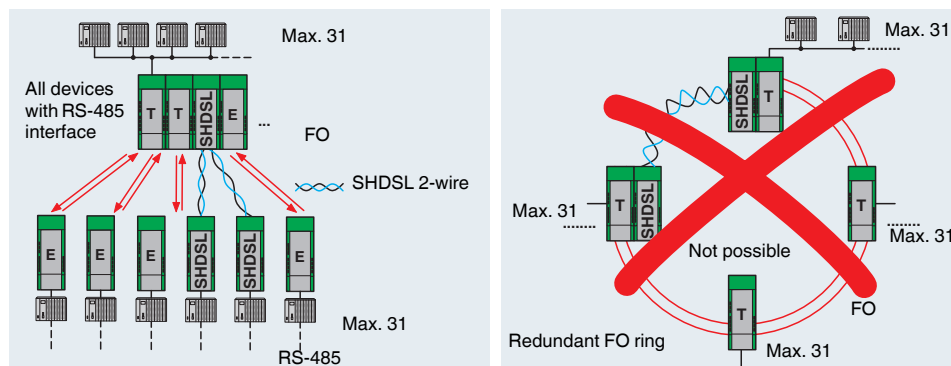
Figure 1-14   Structures that combine copper cables and fiber optics (RS-485)

Structures that combine copper cables and fiber optics are supported.
It is not technically possible to replace a part of an FO ring with an SHDSL line.

1.6.6 Branches and branch lines

Branches and branch lines are not supported by the SHDSL modem. SHDSL only supports point-to-point communication and not multipoint communication.

Figure 1-15   Branches and branch lines

2 Hardware installation

Scope of supply

– SHDSL modem
– CD-ROM with PSI-CONF configuration software
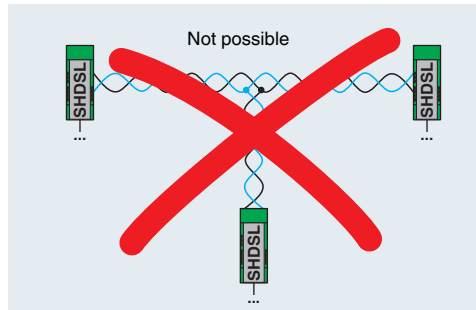– Package slip

Default settings

The device is supplied with the following configuration:

– Line operation
– DSL:
  Automatic data rate detection in the range from 192 kbps to 5.696 Mbps per channel
  DSL port A: active
  DSL port B: active
– Serial interface:
  Automatic DTE/DCE detection activated
  RS-232 activated, 19.2 kbps, no flow control, 8N1 (8 data bits, no parity, 1 stop bit)
  RS-485 deactivated
  RS-422 deactivated
– Digital switching outputs:

DSL A	DO = "24 V"	Good to very good connection
	DO = "open"	No or only moderately good connection
DSL B	DIO = "24 V"	Good to very good connection
	DIO = "open"	No or only moderately good connection

> **i** If you wish to configure the modem differently, you must install the PSI-CONF configuration software.

Tips for easy startup

Point-to-point connection of two devices

• Connect DSL port A of device 1 to DSL port B of device 2.

All LEDs light up during the boot process.

If the device is still set to the default settings, the DIAG LED flashes for approximately 20 s after the boot process.

2.1 Mounting the module on a DIN rail

> **WARNING:**
> Only mount and remove the modem when the power supply is disconnected.

> **NOTE:**
> The DIN rail must be connected to PE to ensure safe operation.

2.1.1 Mounting on a DIN rail (single device)
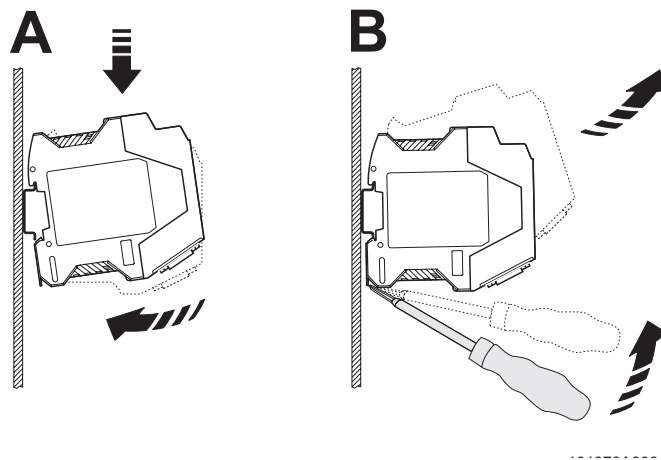
Figure 2-1   Mounting and removal (single device)

Mounting:

- Place the device onto a grounded 35 mm DIN rail from above so that the upper housing keyway hooks onto the top edge of the DIN rail (see Figure 2-1 A).
- Holding the device by the housing cover, carefully push the device towards the mounting surface.
- Once the snap-on foot has been snapped onto the DIN rail, check that it is fixed securely.

Removal:

- Use a suitable screwdriver to release the locking mechanism on the snap-on foot of the device (see Figure 2-1 B).
- Hold onto the device by the housing cover and carefully tilt it upwards.
- Carefully lift the device off the DIN rail.

2.1.2   Mounting with DIN rail connectors (connection station)

By using an additional system power supply unit (MINI-SYS-PS-100-240AC/24DC/1.5, Order No. 2866983), a redundant power supply is made available for further devices connected in the connection station.

Prior to assembly, two DIN rail connectors (Order No. 2709561) for each modem are inserted into the DIN rail for forwarding the power supply.
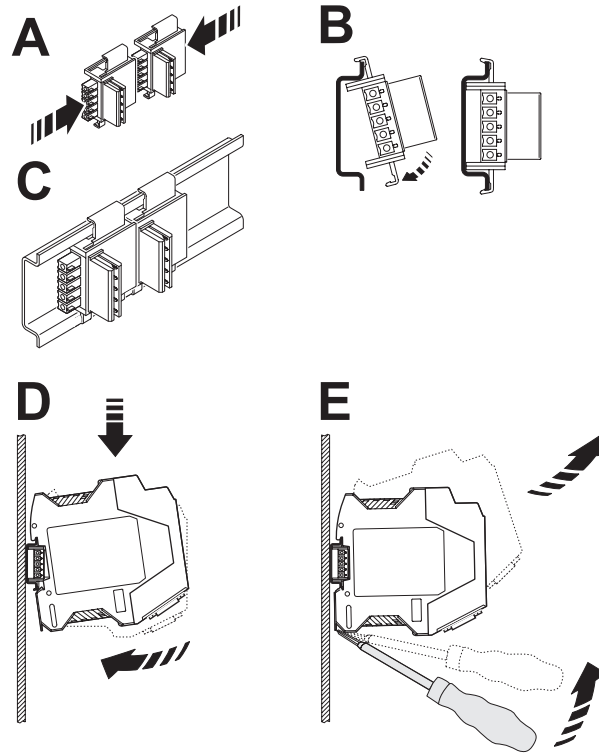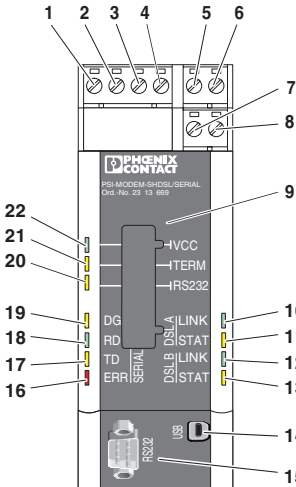
Figure 2-2   Mounting and removal (connection station)

> Make sure that the DIN rail connector and device are aligned correctly.
> - DIN rail connector (plug) left
> - Device (snap-on foot) below

- Push the DIN rail connectors together (A) and insert them into the DIN rail (B/C).
- Place the device onto the DIN rail from above, so that the upper housing keyway hooks onto the top edge of the DIN rail (D).
- Holding the device by the housing cover, carefully push the device towards the mounting surface so that the device bus connector is securely fixed onto the DIN rail connector.
- Once the snap-on foot has been snapped onto the DIN rail, check that it is fixed securely.

2.2 Description of the connections and LEDs

Connection terminal blocks (COMBICON)	1	**24V**	24 V supply	
	2	**0V**	0 V supply	
	3	**DO**	Switching output, digital (24 V, open)	
	4	**DIO**	Switching output, digital (24 V, open)	
	5/6	**A (a)/(b)**	DSL port A (wire pair 1)	
	7/8	**B (a)/(b)**	DSL port B (wire pair 2)	
	9		RS-422/RS-485 interface	
Additional interfaces	14	**USB**	Mini-USB, type B, 5-pos., interface for configuration/diagnostics	
	15	**RS232**	9-pos. D-SUB socket, RS-232 interface	

Status and diagnostic indicators	10 12	**LINK**	(green)	DSL ports	
				OFF	DSL port not active
				OFF (pulsating)	(Flashing every 3 s) DSL port is searching for link device
				Flashing (1 Hz)	Link device found
				Flashing (2 Hz)	Initializing connection
				ON	Connection established
	11 13	**STAT**	(yellow)	DSL ports	
				OFF	No connection established
				OFF (pulsating)	(Flashing every 3 s) Link quality adequate
				ON (pulsating)	(Goes out every 3 s) Link quality good
				ON	Link quality very good
	16	**ERR**	(red)	Error	
				OFF	No error
				Flashing (2 Hz)	Error during boot process (VCC also flashes)
				ON	Telegram error/installation error
	17	**TD**	(yellow)	Transmit SERIAL data	
				OFF	No transmit data
				ON	Transmit data at D-SUB or COMBICON
	18	**RD**	(green)	Receive SERIAL data	
				OFF	No data received at D-SUB or COMBICON
				ON	Receive data at D-SUB or COMBICON
	19	**DG**	(yellow)	Diagnostics	
				OFF	No serious errors
				Flashing (1 Hz)	(Duration: 20 s after boot process) Device is set to factory configuration
				ON	Serious error has occurred
	20	**RS232**	(yellow)	Serial interface	
				OFF	RS-232 interface is deactivated RS-422/RS-485 interface is activated
				Flashing (1 Hz)	RS-232 interface is activated but not connected RS-422/RS-485 interface is deactivated
				ON	RS-232 interface is activated and connected RS-422/RS-485 interface is deactivated
	21	**TERM**	(yellow)	Termination (termination resistor) - only relevant for RS-485	
				OFF	Integrated termination resistor is deactivated or no RS-485 interface is configured
				ON	Integrated termination resistor is activated
	22	**VCC**	(green)	Supply voltage	
				OFF	No supply voltage
				Flashing (1 Hz)	Supply via USB (only for configuration)
				Flashing (2 Hz)	Error during boot process (ERR also flashes)
				ON	Supply voltage OK, modem is ready to operate

i Additional information about the LEDs can be found in the PSI-CONF configuration software (under device diagnostics).

2.3 Establishing connections

2.3.1 Safety notes

⚠	**WARNING: Electrical connection may only be carried out by qualified personnel** The electrical connection, startup, and operation of this device may only be performed by qualified personnel. With respect to the safety notes in this document, qualified personnel are persons who are authorized to start up, to ground, and to mark devices, systems, and equipment according to the standards of safety technology. In addition, these persons must be familiar with all warning instructions and maintenance measures in this document. Disregarding these instructions may result in damage to equipment and/or serious personal injury.
⚠	**WARNING: SELV operation** The PSI-MODEMSHDSL/SERIAL is designed exclusively for SELV operation according to IEC 60950/EN 60950/VDE 0805.
⚠	**WARNING:** The modem may only be connected to devices which meet the requirements of EN 60950 (Safety of information technology equipment).

2.3.2 DSL connection

The device has two plug-in DSL connection terminal blocks, each with the connections (a) and (b).
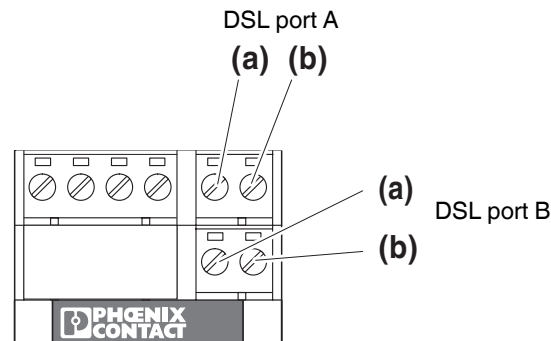

Figure 2-3   DSL connection

NOTE:
Never connect DSL port A to DSL port B on the same device (DSL loop).

In order to make data transmission less susceptible to interference, we recommend using shielded twisted pair cables.

You can use **star-quad twisted cables**. With these cables, use the individual wires on the opposite side to avoid crosstalk (see Figure 2-6 on page 2-8). This should be observed in particular in 4-wire operation.

When crosstalk is intensive, the data rate can drop sharply. At worst, no SHDSL connection is established between the two devices.

The modem is preset for line operation. You can switch to 4-wire operation via the PSI-CONF configuration software.
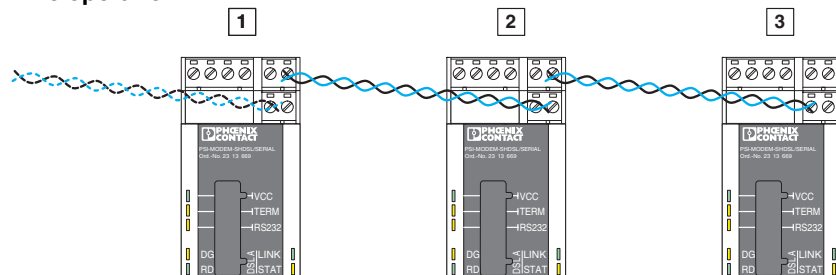
Line operation

Figure 2-4   Line operation

• For line operation, connect DSL port A (a and b) to DSL port B (a and b) of the next modem. Connect a and b as desired.
  DSL port B of the first device and DSL port A of the last device are not used.

4-wire connection (line redundancy or speed increase)

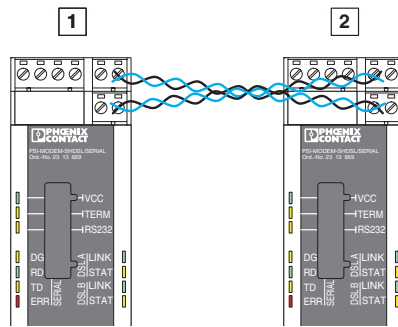| i | The 4-wire connection can be used for line-redundant operation or to increase the speed. |

Figure 2-5   4-wire connection

- For 4-wire connection, connect DSL port A (a and b) of the first modem to DSL port B (a and b) of the second modem. Connect a and b as desired.
- Connect DSL port A (a and b) of the second modem to DSL port B of the first modem (a and b).

| i | In the case of **star-quad twisted cables**, use the individual wires on the opposite side (1a/1b or 2a/2b) to avoid crosstalk. |
| | When crosstalk is intensive, the data rate can drop sharply. At worst, no SHDSL connection is established between the two devices. |
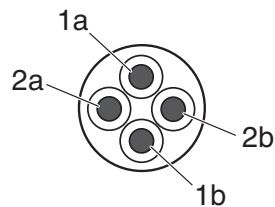
Figure 2-6   Star-quad twisted cables

| i | In the case of extremely long lines that are susceptible to interference, automatic detection of the data rate may not be possible. |
| | In this case, specify a fixed data rate via the PSI-CONF configuration software. |

Both "LINK" LEDs indicate which stage of connection establishment the modem is in. If the "LINK" LED is permanently on, the connection has been established.

| i | Short flashing of the green "LINK" LEDs indicates that the DSL port is not disabled. |

The two "STAT" LEDs indicate the link quality. The longer the LED lights up, the better the link quality (see page 2-4).

2.3.3   Connecting switching outputs

ℹ️

In order for the switching outputs (DO/DIO) to function, the modem must be supplied with voltage via the COMBICON plug-in connectors. This is not possible when voltage is supplied via USB or the DIN rail connector.
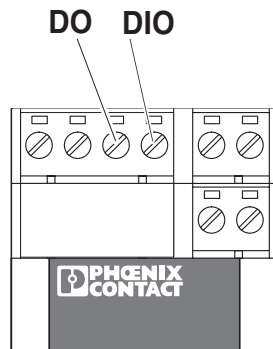
Figure 2-7   Digital switching outputs:

The modem has two digital switching outputs.
–   DO switching output, digital (24 V, open)
–   DIO switching output, digital (24 V, open)

You can set the switching outputs via the PSI-CONF configuration software.

2.3.3.1   Default settings

DSL A	DO = "24 V"	Good to very good connection
	DO = "open"	No or only moderately good connection
DSL B	DIO = "24 V"	Good to very good connection
	DIO = "open"	No or only moderately good connection

Connection

🛈

NOTE: If outputs are used, you must connect a minimum load of 20 kΩ.

•   Connect the cable to the corresponding screw terminal block.

2.3.4 Connecting the serial interface

⚠️ **WARNING:**

The modem may only be connected to devices which meet the requirements of EN 60950 (Safety of information technology equipment).

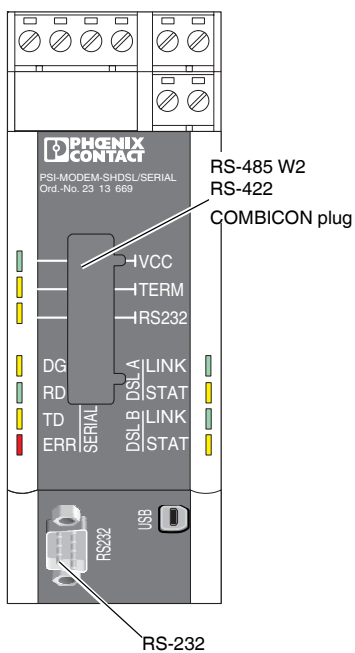| Interface basics	
RS-232	See "RS-232" on page 1-6
RS-422	See "RS-422" on page 1-7
RS-485 W2	See "RS-485 W2" on page 1-8

Figure 2-8   Serial interfaces

RS-232 interface
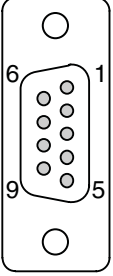
> ℹ️ We recommend using shielded data cables.

> ℹ️ For devices that are connected to the **RS-232** interfaces, the modem automatically switches between DCE and DTE by default.

The RS-232 interface is a 9-pos. D-SUB plug. All signals except for the RI (Ring Indicator) signal are present.

The interface has ground reference and is not electrically isolated from the potential of the supply voltage.

Table 2-1   Assignment of the RS-232 interface (D-SUB)

Contact	Signal	Comment	Assignment
1	DCD	Data carrier detect	
2	TxD	Transmit	
3	RxD	Receive	
4	DTR	Data terminal ready	
5	GND	Signal ground	
6	DSR	Data set ready	
7	CTS	Clear to send	
8	RTS	Request to send	
9	–		

Automatic DCE/DTE switchover (RS-232)

The modem automatically detects whether a DCE or DTE device is connected to the RS-232 interface. The advantage of this is that cabling is easier. However, this can lead to problems in some special cases.
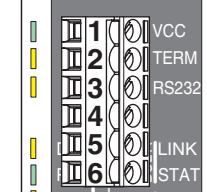
– If two SHDSL devices are connected via a single RS-232 cable, automatic DCE/DTE detection must be disabled on one of the devices.

– If the third-party device switches between DCE and DTE during operation (e.g., because a switch has been actuated), the modem does not detect this change. The same is true when a cable that can be switched is switched.

  In this case, the serial cable must be disconnected from the SHDSL modem and plugged back in again.

RS-485 W2/RS-422 interface

In addition to the D-SUB plug, a 6-pos. COMBICON plug is used. The pin assignment is as follows:

Table 2-2   Assignment of the RS-485/RS-422 interface (COMBICON)

Contact	RS-485 W2	RS-422	Assignment
1	-	R(N)	
2	-	R(P)	
3	D(A)	T(N)	
4	D(B)	T(P)	
5	GND	GND	
6	Shield	Shield	

The interface is electrically isolated from all other isolated groups.
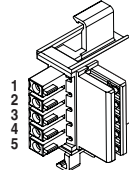
In the case of the RS-485 version, the T-BUS DIN rail connector can be used for data transmission. Star structures can also be created (see "Star structure via DIN rail connector and RS-485 interface" on page 1-12).

ℹ️ RS-232 and RS-422 do not support data transmission via the DIN rail connector. However, power supply is possible.

T-BUS DIN rail connector

Table 2-3   Assignment of the DIN rail connector (T-BUS)

Contact	Signal	Comment	Assignment
1	24 V	Supply voltage, 24 V	
2	0 V	Supply voltage, 0 V	
3	GND	Common ground	
4	D(A)	Local bus (RS-485 only)	
5	D(B)	Local bus (RS-485 only)	

The interface has ground reference and is not electrically isolated from the potential of the supply voltage.

ℹ️ In principle, a star structure via the DIN rail connector can only be used in combination with RS-485 mode.

2.3.5 Connecting the USB interface

You can configure the modem or read diagnostic information via the USB interface.

Power can also be supplied via USB for configuration purposes. The "VCC" LED flashes at 1 Hz in this case. SHDSL operation is not possible.

To connect the modem to a computer, use the CABLE-USB/MINI-USB-3,0M cable (Order No. 2986135).

> The USB interface is used to configure the modem via the PSI-CONF configuration software.
>
> The USB interface cannot be used for data transmission.
>
> DSL operation is not possible when power is supplied via USB.

- Connect the mini-USB plug (type B) to the modem and the USB plug to your computer.

2.3.6   Connecting the supply voltage

WARNING: The PSI-MODEMSHDSL/SERIAL is designed exclusively for SELV operation according to IEC 60950/EN 60950/VDE 0805.

The supply voltage must be between 18 V DC and 30 V DC.

Supply the supply voltage to the module via the "24V" and "0V" terminal blocks or with the system power supply unit via the DIN rail connectors (T-BUS).

You can supply other modules up to a maximum of 1.5 A via the device.

The terminal blocks for connecting the supply voltage, the switching outputs, and both DSL ports are COMBICON plugs (plug-in screw terminal block). They can be removed and have a keying profile that prevents plugs being mixed up.

Power can also be supplied via USB, but this is purely for configuration purposes. The "VCC" LED flashes at 1 Hz in this case. DSL operation is not possible.

Connection to the module

• Connect the 24 V supply voltage to the "24V" and "0V" terminal points.
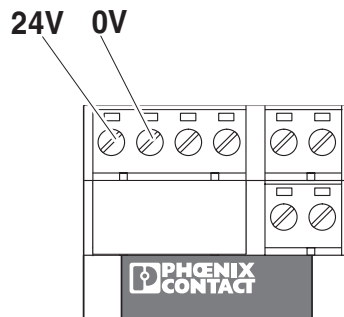As soon as the "VCC" LED lights up, the modem is ready to operate.

Figure 2-9   Connecting the supply voltage

Using the system power supply unit (optional)

NOTE:
In order for the switching outputs (DO/DIO) to function, the modem must be supplied with voltage via the COMBICON plug-in connectors. It is then not possible to supply the voltage supply via USB or the DIN rail connector.

• Connect the MINI-SYS-PS 100-240AC/ 24DC/1.5 system power supply unit (Order No. 2866983) using two DIN rail connectors (Order No. 2709561) to the left of the PSI-MODEM-SHDSL/SERIAL
(see "Mounting with DIN rail connectors (connection station)" on page 2-3).

As soon as the "VCC" LED is permanently on, the modem is ready to operate.
If the LED is off, no operating voltage is present. If it flashes at 1 Hz, the device is being supplied via USB and if flashing at 2 Hz this indicates that an error occurred when booting.

The SHDSL modem has a limited temperature range. The temperature range depends on whether the modem is supplied via COMBICON plugs or via DIN rail connectors (T-BUS).

Ambient temperature range

Operation (no other modules supplied via the device):

–	Freestanding (40 mm spacing)	-20°C ... +60°C
–	Connected in series (low power dissipation of modules connected in series)	-20°C ... +55°C
–	Connected in series (without restrictions)	-20°C ... +50°C

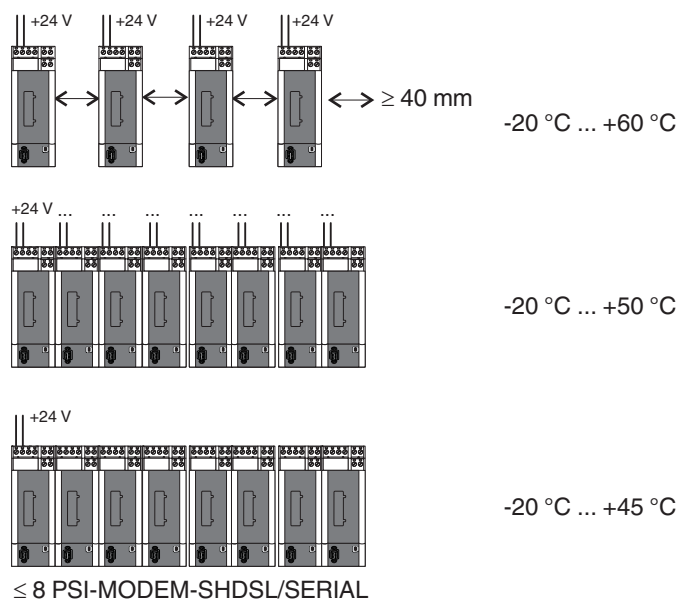|	
Operation (other modules supplied via the device, 1.5 A, maximum)	-20°C ... +45°C
Storage/transport	-40°C ... +85°C

≤ 8 PSI-MODEM-SHDSL/SERIAL

Figure 2-10   Temperature range

2.4 Use in potentially explosive areas

The PSI-MODEMSHDSL/SERIAL is designed for use in potentially explosive areas that require **category 3G equipment**.

Special conditions

Observe the specified conditions for use in potentially explosive areas.

WARNING: Explosion hazard

Install the device in suitable **housing with IP54 protection, minimum,** that meets the requirements of EN 60079-15.

WARNING: Explosion hazard

Disconnect the block power supply **before**:
– Snapping it on or disconnecting it.
– Connecting or disconnecting cables.

WARNING: Explosion hazard

The **mini-USB configuration interface** may only be used if it has been ensured that there is no potentially explosive atmosphere present.

WARNING: Explosion hazard

Connection to the **D-SUB interface** is only permitted if the screw connection is fully tightened.

WARNING: Explosion hazard

Only devices which are designed for operation in zone 2 potentially explosive areas and are suitable for the conditions at the installation location may be connected to the signal circuits in zone 2.

3 Configuration via PSI-CONF

The device is supplied with the following configuration:
– Line operation
– DSL:
  Automatic data rate detection in the range from 192 kbps to 5.696 Mbps per channel
  DSL port A: active
  DSL port B: active
– Serial interface:
  RS-232 activated, 19.2 kbps, no flow control, 8N1 (8 data bits, no parity, 1 stop bit)
  RS-485 deactivated
  RS-422 deactivated
– Digital switching outputs:

DSL A	DO = "24 V"	Good to very good connection
	DO = "open"	No or only moderately good connection
DSL B	DIO = "24 V"	Good to very good connection
	DIO = "open"	No or only moderately good connection

> **i** If you wish to configure the modem differently or would like to use the diagnostic function, you must install the PSI-CONF configuration software.

3.1 Installing PSI-CONF

The PSI-CONF software is used to configure the PSI-MODEMSHDSL/SERIAL. The configuration software supports:
– Configuration of serial interfaces (selection of active interface, data rate, handshake, etc.)
– Changes to the configuration of digital switching outputs
– Changes to the DSL transmission speed
  – 4-wire operation:
    64 kbps ... 30 Mbps (manual setting of the data rate)
    384 kbps .... 11.392 Mbps (automatic detection of the data rate)
  – 2-wire operation:
    32 kbps ... 15.3 Mbps (manual setting of the data rate)
    192 kbps ... 5.696 Mbps (automatic detection of the data rate)
– Assignment of device names
– Assignment of line names
– Printing project/device files
– Diagnostic function
– Reading the log book
– Update firmware
– Reset to default settings

Connection requirements

– A PC with a Windows operating system is required in order to use the configuration software.

– For configuration purposes, the modem can be supplied via an external power supply unit or via the USB interface.

– The computer that is to be used for configuration must support connection to the USB socket on the modem.
Use the following USB cable for this: CABLE-USB/MINI-USB-3,0M, Order No. 2986135.

Installation

• Download the latest version of PSI-CONF at www.phoenixcontact.net/catalog or start the file from the CD-ROM supplied.

• When the CD-ROM is inserted, the "index.html" file will launch automatically in your browser. If this file does not open, double-click on it to start it.

• Select a language (English, German or Chinese).

A window appears listing devices that can be configured with the software on the left-hand side.

• Select the PSI-MODEMSHDSL/SERIAL in the navigation bar on the left.

• Click on "Configuration Software" to install the software on your computer.

To start the software, Microsoft NET Framework 2.0 must be installed on your computer. If not already installed, it will be installed automatically.

A USB driver is also required, which is installed automatically during software installation.

For further instructions, please refer to the help file for the installation program.

3.2 Getting started

A welcome screen appears.

3.2.1 Selecting the language

PSI-CONF is started in English or German depending on the operating system. You can select the desired language.

- To do this, click on "Language"/"Sprache" in the menu at the top left and select "English - Englisch", "German - Deutsch" or "Chinese Simplified".

3.2.2 Selecting the device

- Next, select the device that you wish to configure. In this case, select the PSI-MODEM-SHDSL/SERIAL by double-clicking.
- A new dialog box appears which provides support during configuration. PSI-CONF always starts in offline mode (the active mode is highlighted in green).

3.2.3 Connection mode

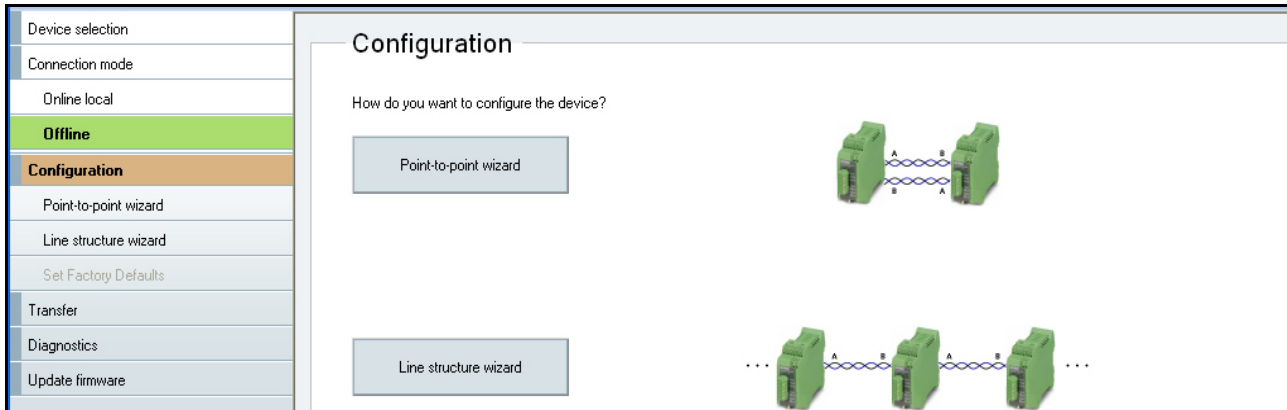| Connection mode		
Offline	**Local configuration**	For this, the computer and modem must be connected via the USB cable. Configuration is performed directly.
		The software switches to online mode.
	Configuration file	You can create a new project or open an existing project.
		A new window appears when you click on "Configuration file". Here you can choose between "New project" or "Open project".
		The configuration is created and saved offline on the computer. It will be transferred to the modem later.

3.3   Configuration

Configuration (local configuration or configuration file)	
Point-to-point wizard	Configuration of the connection between two modems. A 2 or 4-wire connection is possible.
	To create a **star structure**, please refer to the notes in Sections 1.6.3 to 1.6.5.
Line structure wizard	Configuration of a line structure with a 2-wire connection. A network can be configured via several steps for up to 255 devices.

Configuration >> Point-to-point wizard or Line structure wizard	
Step 1: Project configuration	In the case of the line structure wizard, you first need to determine how many devices are to be connected (3 to 255 devices supported). In the case of the point-to-point wizard, two devices are connected to each other.
	Select a file name and storage location for the configuration file. The extension of the project file is *.dat.
	Click on the "....\" button and select a storage location. The default file name is "NewProject.dat" and can be changed.
	You can save the file at any time via the "File, Save" menu. Otherwise, the file will be saved once the wizard is finished.
	A file that is not yet saved is indicated in the title bar with an *.
Step 2: Assign device names	Each device already has a name (Device 1, Device 2, etc.). You can select a device by clicking on it or using the "Last device"/"Next device" buttons and assign a new name, e.g. "Modem A" or "Pumping station". The name can contain 255 characters including special characters.

Configuration >> Point-to-point wizard or Line structure wizard	
Step 3: DSL line configuration	The line already has a name (DSL line 1, etc.). You can assign a new name, e.g., "Line to hall A". The name can contain 255 characters including special characters.
	In the case of the point-to-point wizard, you can specify under "**DSL line arrangement**" whether it is a 2-wire or 4-wire line. In the case of the line structure wizard, only 2-wire lines are configured.
	The 4-wire line can be designed redundantly or optimized for speed.
	– Line redundancy: if a line fails, data is transmitted on the other cable.
	– Speed optimized: if a line fails, restrictions may occur.
	DSL line
	For the DSL line, specify the cable length in meters and the cable diameter. This is used to determine the expected data rate for the DSL line.
	Under DSL data rate, select either "Automatic" or "Manual".
	You can set the data rate individually for each line. If the data rate is the same for every line, click on "Accept for all".
	DSL data rate: automatic
	In the case of automatic detection, the modem attempts to achieve the highest DSL transmission speed, taking a reserve of 3 dB into account (in the range of 192 ... 5696 kbps per channel). The automatically determined data rate remains fixed until an SHDSL connection abort. The SHDSL data rate is determined again when the SHDSL connection is re-established. It may deviate from the previous data rate.
	SHDSL data rate: manual
	In the case of extremely long lines that are susceptible to interference, only data rates below 192 kbps may be possible. In this case, automatic data rate detection will not work and the data rate must be specified manually.
Step 4: Serial configuration	You can configure the serial interface globally for all devices or individually for each device.
	Under "Connection profile for all devices", you have the option of selecting a connection profile, creating a new profile or editing an existing one. The settings selected here apply for all devices.
	Connection profiles
	A range of profiles is available. You can select one of these profiles or create your own profile.
	The following settings are made for profiles:
	– **Data transmission mode**: character based or frame based
	In frame-based mode, the parameters are: $T_{FrameEnd}$ and $T_{IdleMin}$
	– **Handshake**: none, as hardware or software method

Configuration >> Point-to-point wizard or Line structure wizard

Data transmission mode

– **Character-based** data transmission is suitable for protocols where the interval between individual characters on the physical layer plays a lesser role. This is the case, for example, when transmitting a file via an RS-232 interface or with the Modbus ASCII protocol.

For character-based protocols, characters may also be transmitted individually or in fragments via the SHDSL modems. Since fragments can be transmitted, the length of a data packet that is to be transmitted in this mode may be of any size. In the case of these protocols, it is first determined on a higher layer whether and when a data packet has reached the end or whether an error has occurred.

– **Frame-based** data transmission must be selected for many fieldbus systems, for example, in the case the Modbus RTU protocol.

For these protocols it is important that the interval between the characters in a frame is limited, so that a frame can still be recognized as such. Here the SHDSL modems transmit the entire frame in one go. The modems support frames up to a maximum length of 504 characters.

There are further setting options here: $T_{IdleMin}$ and $T_{FrameEnd}$

– The $T_{IdleMin}$ parameter relates to the minimum time that must elapse between two successive frames. A certain amount of time must elapse between two frames to prevent the concatenation of multiple frames.

– Once the data has been received by the SHDSL modem, after a specified time has elapsed the modem assumes that the received frame has arrived in its entirety and then transmits it. This time is referred to as $T_{FrameEnd}$.

The $T_{FrameEnd}$ time must be shorter than $T_{IdleMin}$.

Handshake

Handshake (flow control) can be set for RS-232 and RS-422 interfaces.

Flow control manages the pace of data transmission between two termination devices in a data network. In order to prevent a slow receiver being overloaded with data by a fast transmitter, data transmission must be interrupted occasionally. This method enables data to be transmitted as continuously as possible and without losses.

To control data flow, there are two methods for hardware or software. The hardware method is only suitable for RS-232 interfaces.

– In the case of the **hardware method**, additional control lines are used to control data flow: RTS = Request to send/CTS = Clear to send. With this method, the RTS/CTS cables of the relevant RS-232 cable must be utilized.

– In the case of the **software method**, additional control information is added to the user data. The software method is known as "Xon/Xoff".

Configuration >> Point-to-point wizard or Line structure wizard

Settings for selected device

Interface type: RS-232, RS-422, RS-485 W2

Baud rate: 110 ... 2,000,000 bps

Parity: None, Even, Odd, Mark, Space

Stop bits: 1, 1.5 or 2

Data bits: 7 or 8

DCE/DTE Switchover (RS-232 only): Automatic, DCE (device is modem), DTE (device is PC). For information on DCE/DTE switchover, please refer to "RS-232 interface" on page 2-11.

Termination (RS-485 W2 only): the 2-wire bus cable must be terminated at both ends by a termination resistor (100 ... 200 ohms). When "Termination" is activated, the integrated termination resistor in the PSI-MODEMSHDSL/SERIAL is enabled.

You can set the configuration individually for each modem. If the configuration is the same for each modem, click on "Accept settings for all devices".

Configuration >> Point-to-point wizard or Line structure wizard

Step 5: IO configuration	Click on "Edit" to change the default settings. The following window appears.

Under certain conditions (signal quality is no longer good/very good or the DSL or serial connection was interrupted), the DO/DIO can be set to "24 V" or "open".

The diagnostic LED lights up if a serious error is detected. In this case, we recommend reading the diagnostic memory (see "Event log" on page 3-13).

The diagnostic LED remains lit until it is reset. You can specify a fixed time interval for reset (e.g., after 2 minutes) or reset the LED manually. Manual reset is performed using the "Reset DIAG LED" button in the "Diagnostics, Device Status" menu.

Confirm your changes with "OK" or discard with "Cancel". The window is closed.

You can set the configuration individually for each modem. If the configuration is the same for each modem, click on "Accept for all".

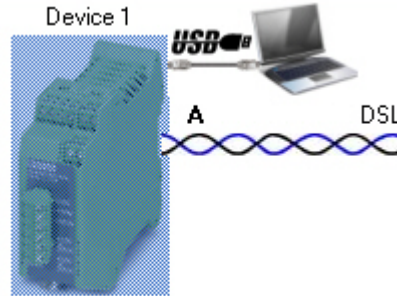|	
Step 6: Summary	A summary of the settings is provided here. Click on "Print" to print out the settings.

Configuration >> Point-to-point wizard or Line structure wizard	
Step 7: Transfer	Online mode is activated automatically for the transfer. • Select the first configured device and connect it via the USB cable. • Wait until communication is established with the device. A window containing a progress bar appears briefly. • Click on "Transfer" to transfer the data to the device connected via USB. • After successful transfer, a green bar appears displaying "Transferred" and the serial number of the device. A USB symbol also appears. • Select the next device and connect it via the USB cable. • Wait until communication is established with the device. A window containing a progress bar appears briefly. • Click on "Transfer" to transfer the data to the device connected via USB. Repeat the steps until all devices are configured. • Click on "Finish" to save the configuration file.

3.3.1   Setting default settings

Configuration >> Set default settings	
Set default settings	This function is only available in online mode. The device is supplied with the following configuration: – Line operation – DSL: Automatic data rate detection in the range from 192 kbps to 5.696 Mbps per channel DSL port A: active DSL port B: active – Serial interface: RS-232 activated, 19.2 kbps, no flow control, 8N1 (8 data bits, no parity, 1 stop bit) RS-485 deactivated RS-422 deactivated – Digital switching outputs: DSL A, DO = "24 V", in the case of "good to very good connection" DSL A, DO = "open", in the case of "no or only moderately good connection" DSL B, DIO = "24 V", in the case of "good to very good connection" DSL B, DIO = "open", in the case of "no or only moderately good connection"

3.4   Diagnostics

Diagnostics is only available in online mode.

The diagnostic data of the module, which is connected via USB is displayed.

Reading diagnostic data can be stopped ("Stop reading" button) and restarted ("Read device status" button).

You can manually reset the diagnostic LED using the "Reset DIAG LED" button.

3.4.1 Diagnostic overview
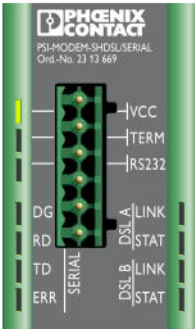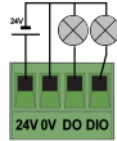
Diagnostics >> Device status >> Diagnostic overview		
Device information	**Type**	The designation clearly identifies the type of the selected device. The designation is also printed on the device.
	Order No.	The order number can be used to clearly identify the device type. You can use this number to search for additional information and downloads for this device on the Phoenix Contact website. The order number is printed on the device.
	Serial No.	The serial number is unique for each device. It can be used to assign a device and is printed on the device.
	Device name	This is the name of the device that you assigned during configuration.
	Operating mode	Line structure or point-to-point.
	DO status	Indicates the status of the diagnostic output (DO). If the event linked to the port occurred, the status is "set". The physical port status is specified in brackets and can be either "open" or "24 V".
	DIO status	Indicates the status of the digital IO (DIO). If the event linked to the port occurred, the status is "set". The physical port status is specified in brackets and can be either "open" or "24 V".
	Interface type	Interface type indicates the interface used by the device.

Diagnostics >> Device status >> Diagnostic overview			
Serial interface	**Data rate**		The speed of the serial connection.
	Status		
		RS-232 connection	Status of the RS-232 connection.
		Flowcontrol	Status of flow control.
		Port A	Indicates whether serial data is received via DSL connection A. Errors are also indicated.
		Port B	Indicates whether serial data is received via DSL connection B. Errors are also indicated.
		D-SUB	1. No data reception.
			2. Data is received.
			3. Incorrect configuration. A character-based protocol must be configured.
			4. Noise at the interface.
			5. An incorrect data rate is probably set. The parameterized data rate of the device is lower than the actual data rate.
			6. The data is arriving at the serial interface faster than it can be read. – Reduce the data rate of the serial interface. – Set longer pause times between the data packets/telegrams.
			7. A few errors at the interface. This can result in significant errors, for example. A configuration error is probably present, e.g., due to an incorrect data rate or a short circuit on the data cable.
			8. Many errors at the interface. A configuration error is probably present, e.g., due to an SHDSL data rate that is too high or a short circuit on the data cable.
			9. Sporadic parity errors at the serial interface. Check the wiring of the serial interface. If the serial data cable is relatively long or the quality is not good, decrease the serial data rate.
			10. Over 40% of data packets have parity errors. This can only be down to a configuration error.Check whether the following device settings are correct and correspond to the data to be transmitted: – Parity – Data bits (7 or 8 bits) – Stop bits – Data rate
			11. The data packets sporadically contain errors relating to the stop bit. Check the wiring of the serial interface. If the serial data cable is relatively long or the quality is not good, decrease the serial data rate.

Diagnostics >> Device status >> Diagnostic overview		
		12. A large number of data packets contain errors relating to the stop bit. Check whether the following device settings are correct and correspond to the data to be transmitted: – Parity – Data bits (7 or 8 bits) – Stop bits – Data rate
		13. Software buffer overflow. The data is being received via the SHDSL interface faster than it can be output to the serial interface. If your system operates with various different serial parameters: make sure the parameters of all serial interfaces are the same. This applies in particular to the data rate. If all the serial parameters in your system are identical, decrease the serial data rate of all serial interfaces or reduce the data load. If RS-232 or RS-422 interfaces are used in a line structure, make sure that they are only operating in half duplex mode.
DSL ports	**Line name**	This is the name of the line that you assigned during configuration.
	Link status	The link status indicates the status of the SHDSL connection.
	Link losses	The number of connection losses since the last boot.
	Data rate	The speed of the SHDSL connection. The lower the data rate, the greater the distance of the DSL line.
	Link quality	Quality of the DSL connection at port A or B.
	Network load (RX/TX)	Network load for outgoing (TX) and incoming (RX) data traffic.
	Error diagnostics	Indicates how strongly SHDSL data traffic is disturbed.

3.4.2 Event log

The event log can be printed or exported as a ".csv" file via the "Export" button.

Diagnostics >> Event log			
Event log	**Type**		The type of event. Possible values include: "Error", "Warning" or "Information".
	Time based on PC clock		Date and time of the event (based on the PC clock).
	ID		The event ID. The IDs of diagnostic messages are described under "Diagnostic IDs" on page 5-1.
	Event description		The description of the event.
	Port		The port to which the event is assigned.
	Seconds since boot		The time in seconds between the event and the time of the last boot procedure.

3.4.3 Value log

The value log can be printed or exported as a ".csv" file via the "Export" button.

| Diagnostics >> Value log			
Value log	**Type**	The type of event. Possible values include:	
		– Cyclic value: a value is recorded every 3 minutes	
		– Event: only recorded when an event occurs	
	Time based on PC clock	Date and time of the event (based on the PC clock).	
	Port A/B Data rate	The speed of the SHDSL connection. The lower the data rate, the greater the distance of the DSL line.	
	Port A/B Link losses	The number of connection losses since the last boot.	
	Port A/B SNR	The signal-to-noise ratio (SNR) is the ratio between the average useful signal strength and the average noise strength of the interference signal. The greater the signal-to-noise ratio, the higher the transmission quality.	
		The signal-to-noise ratio mainly depends on the cable attenuation and the interference signals that influence the cable (e.g., from adjacent cables).	
	Port A/B Line attenuation	Reduction of the signal during transmission in dB. The lower the line attenuation, the higher the transmission quality.	
		The line attenuation mainly depends on the cable length, the cable cross section, and the data rate.	
	Port A/B Error diagnostics	Indicates how strongly DSL data traffic is disturbed.	
	Port A/B RX network load	Network load for incoming data traffic.	
	Port A/B TX network load	Network load for outgoing data traffic.	
	Port A/B Link quality	Quality of the data link.	
	Port A/B Link status	The link status indicates the status of the connection.	
	D-SUB/COMBICON status	Indicates the status of the serial connection via the D-SUB or COMBICON interface of the device.	
	T-BUS status	Indicates the status of the serial connection via the T-BUS DIN rail connector.	

Diagnostics >> Value log

	Remote port A/B status	Indicates the status of the serial connection via remote port A/B of the device.
	RS-232 connection status	Indicates the status of the serial connection via the RS-232 interface.

3.5 Transfer
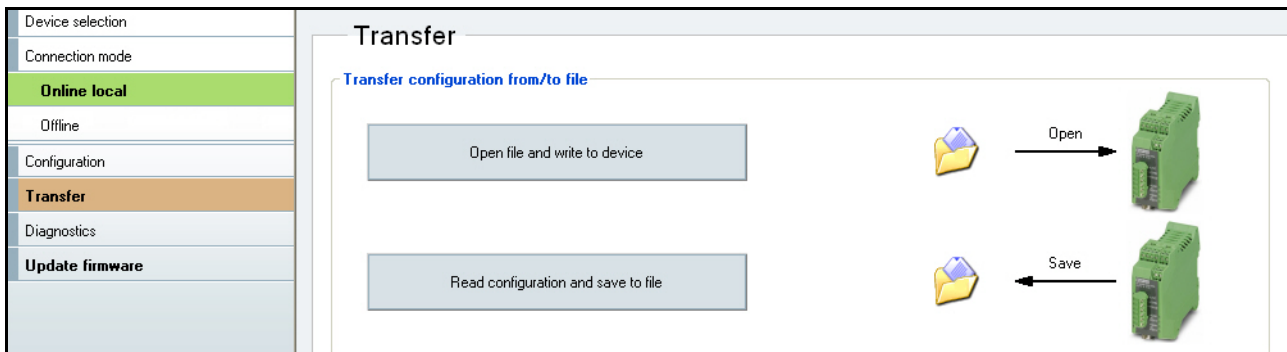
Transfer

Open file and write to device or Read configuration and save to file	This function is only available in online mode.
	There are two options:
	1. You can open an existing file and save it to the modem connected via USB.
	2. You can read the existing configuration and save it to a file.
	The file extension is ".dat".

3.6 Firmware update

⚠ **NOTE: The device must not be disconnected from the PC or the power supply during a firmware update as this can cause damage to the device.**

In order to benefit from a wider range of functions, you can download the latest firmware at www.phoenixcontact.net/catalog and transfer it to your device.

To update the firmware, you must switch to online mode.

Update firmware			
Device informations	**Type**		The designation clearly identifies the type and function of the selected device. The designation is printed on the device.
	Order No.		The order number can be used to clearly identify the device type.
	Serial No.		The serial number is unique for each device. It can be used to assign a device and is printed on the device.
	Hardware version		The hardware version number clearly indicates the hardware version of the device. The two-digit number is printed on the device.
	Firmware version		The firmware version number clearly indicates the firmware version of the device. The three-digit number is printed on the device.
	Release date		The date the firmware was released.
Update firmware	**Open firmware**		Find and open firmware file (.bin) on data carrier.
	Firmware file		Name of the open firmware file.
	Firmware version		Firmware version of the update.
	Release date		The date the firmware to be installed was released.
	Start update		The selected firmware file is transferred to the device connected via USB.

4   Optimization

4.1   Optimizing the SHDSL data rate

The cable length and cable cross section have a major influence on the SHDSL data rate. In turn, the SHDSL data rate influences the maximum possible serial data rate.

The PSI-CONF configuration software calculates the expected SHDSL data rate from the cable length and cable diameter. The SHDSL data rate determined in this way is the basis for the maximum serial data rate.

If the calculated SHDSL data rate in SHDSL auto mode (automatic detection) does not correspond to the real conditions, the following scenarios are possible:

1. In the real application, the **SHDSL data rate** is **worse** than the configuration software assumes. In the event of high data traffic, data packets may be lost.
2. In the real application, the **SHDSL data rate** is **better** than the configuration software assumes. Under some circumstances, a higher serial data rate is possible.
3. The SHDSL cables are subject to strong external **sources of interference**.

Possible solutions are described below for scenarios 1 and 2. For scenario 3, solutions are recommended under "Increasing immunity to interference" on page 4-2.

Scenario 1: DSL data rate is worse than assumed

Proceed as follows:
- Establish the line in the field. Make sure that the DSL data rate is set to "automatic" (see "Step 3: DSL line configuration" on page 3-6).
- Using the diagnostic function, display the actual SHDSL data rate on the line (see "Diagnostic overview" on page 3-10).
- On the computer, create the configuration project and set the SHDSL data rate to "manual" (see "Step 3: DSL line configuration" on page 3-6).
- Enter the DSL data rate that you measured on the real line. The real measured SHDSL data rate will be **less** than the calculated setting.

The configuration software calculates a new, maximum possible serial data rate and adjusts the SHDSL devices accordingly.

Scenario 2: serial data rate improvement

If your required serial data rate needs to be higher than the data rate recommended by the program, you can proceed as follows:
- Establish the line in the field. Make sure that the DSL data rate is set to "automatic" (see "Step 3: DSL line configuration" on page 3-6).
- Using the diagnostic function, display the real SHDSL data rate on the line (see "Diagnostic overview" on page 3-10).
- Open the existing project and set the DSL data rate to "manual" (see "Step 3: DSL line configuration" on page 3-6).
- Enter the SHDSL data rate that you measured on the real line. It must be greater than the setting calculated by the configuration software. Otherwise, there can be **no** improvement to the serial data rate.

If, despite this optimization, the desired serial data rate is not displayed in the program, you need to operate your system with a lower serial data rate.

4.2 Increasing immunity to interference

If the SHDSL cables are subject to strong external sources of interference, you should further increase the immunity to interference of data transmission. This means that the lower the SHDSL data rate, the higher the immunity to interference.

> **i** The lower the serial data rate, the lower the required SHDSL data rate and the more immune the system is to interference.
>
> Therefore, for your application, select the lowest possible serial data rate.

Formulas for determining the SHDSL data rate which offers the best possible immunity to interference

There are two formulas for an SHDSL serial device. Which of the two formulas is appropriate depends on whether serial data transmission is character or frame based.

1. Character-based transmission (standard)

   SHDSL data rate$_{\text{Maximum immunity to interference}}$ = Data rate$_{\text{Serial x}}$ 1.34 + 8 kbps

2. Frame-based transmission

   SHDSL data rate$_{\text{Maximum immunity to interference}}$ = Data rate$_{\text{Serial x}}$ 4.76 + 8 kbps

You must set this SHDSL data rate manually. Proceed as follows:

- Set the DSL data rate to "manual" (see "Step 3: DSL line configuration" on page 3-6).
- Enter the SHDSL data rate you require.

  Use the lowest possible serial data rate that your application permits.

  The lower the serial data rate, the better the immunity to interference.

Example (formula for "character-based transmission")

SHDSL line	100 m
Cable diameter	1.4 mm (1.539 mm^2)
SHDSL data rate calculated by the configuration software	10,714 kbps

Calculate new SHDSL data rate for maximum immunity to interference

Lowest possible serial data rate (application-specific)	500 kbps
SHDSL data rate$_{\text{Maximum immunity to interference}}$	500 kbps $_x$ 1.34 + 8 kbps
	678 kbps

Check

SHDSL data rate calculated by the configuration software	10,714 kbps
SHDSL data rate$_{\text{Maximum immunity to interference}}$	678 kbps

SHDSL data rate$_{\text{Maximum immunity to interference}}$ should be **less** than the automatically determined data rate.

> **i** Your calculated SHDSL data rate$_{\text{Maximum immunity to interference}}$ must always be less than the SHDSL data rate calculated by the configuration software.
>
> If the SHDSL data rate$_{\text{Maximum immunity to interference}}$ is greater than the configuration software data rate, you must reduce the serial data rate.

5   Eliminating errors

5.1   Diagnostic IDs

Table 5-1   Diagnostic IDs

No.	Meaning	LED	Possible cause(s)	Remedy
Event				
001	Flash memory defective	VCC LED and ERR LED are blinking (2 Hz)	Flash memory partly defective	Replace device
002	reserved			
003	4-conductor connection with three devices	ERR LED and DIAG LED on	The device is configured in 4-conductor mode, however, two different devices are recognized which are connected via SHDSL.	The 4-conductor mode functions only as a point-to-point connection. The devices must be wired as provided in the configuration wizard.

004	Massive interference is disturbing data transmission	ERR LED and DIAG LED on	– Interference on the DSL path
			– Crosstalk on the DSL path
				DSL port A or B errors
				Check DSL installation:
				    – Check whether the wire pair is connected correctly (twisted pair, star quad stranding).
				    – Check cables for line interruption / short circuit
				    – If available, connect cable shield
				– Reduce DSL data rate
				– Reduce external interferences, if possible

005	Frequent link losses	ERR LED and DIAG LED on	The DSL path was interrupted several times within a short time (8 times in 10 minutes at least):
			1. by unplugging the connector several times
			2. by an incorrect configuration of the link partner
			3. by a data rate that was set too high.
			by an incorrect installation
				1. –
				2. Compare the device configuration with the configuration of the neighboring device.
				    – Both devices must have the same project profile or
				    – Both device must have the factory configuration
				3. Reduce the data rate.
				4. Check DSL installation:
				    – Check whether the wire pairs are connected correctly (twisted pair, star quad stranding)
				Check cables for line interruption / short circuit

006	reserved			

Table 5-1   Diagnostic IDs

No.	Meaning	LED	Possible cause(s)	Remedy

007	Link quality sufficient	DSL STAT LED pulsing (short flashes every 3 s)	The link quality was specified as "sufficient" which is due to
			1. Massive interference, high crosstalk to another cable
			2. A too high data rate
			3. A too long/poor cable
				1. Check DSL installation:
				  – Check whether the wire pair is connected correctly (twisted pair, star quad stranding).
				  – Check cables for line interruption / short circuit
				  – If available, connect cable shield
				2. Reduce DSL data rate
				3. Reduce DSL data rate

008	Devices connected as a ring	ERR LED and DIAG LED on	Installation error: A closed ring was created in the „Linear structure" operating mode	The ring must be interrupted.
009	Error when booting the SHDSL controller	VCC LED and ERR LED blinking (2 Hz)	SHDSL chip defective	Replace device
010	Device is connected to itself	ERR LED and DIAG LED on	Installation error: 1. A link has been established between DSL ports A and B of a device. 2. Due to a direct link or heavy crosstalk, for example, if the lines of SHDSL_A and SHDSL_B are in the same cable.	1. Check the cable resistance between SHDSL_A and SHDSL_B. 2. Check whether the wire pairs are connected correctly (twisted pair, star quad stranding) 3. Check cables for line interruption/ short circuit
011	A device configured as 4-conductor tries to connect to a device that is not configured as 4-conductor.	ERR LED and DIAG LED on	Wrong device configuration. Mixed operation between devices with different configurations – Linear structure (2-conductor) – and point-to-point structure (4-conductor)	Configure the devices correctly using the PSI-CONF software.
012	reserved			
013	reserved			
014	reserved			
015	reserved			
016	reserved			
017	Collisions on the RS-485 interface	ERR LED and DIAG LED on	Data packets received on the SHDSL line should be sent to the RS-485 port, although data is simultaneously received by this port. That means, the timing of the system does not fit.	The SHDSL lines may produce large latency times. Timeout periods of the system may need to be adjusted accordingly, i.e. be increased.
018	Loss of data on the serial interface	ERR LED and DIAG LED on	Data arrives faster on the serial port as it can be read.	– reduce data rate of serial Interface – larger pause times between data packets / messages

Table 5-1 Diagnostic IDs

No.	Meaning	LED	Possible cause(s)	Remedy
019	Protocol of the serial interface contains too long frames	ERR LED and DIAG LED on	A frame-oriented transmission was configured. In this configuration, frames up to a length of 500 characters can be transmitted. But frames with more than 500 characters are received.	– If the protocol does not contain frames in that length: – Check if the frame end-time is set correctly. – If the protocol does contain frames in that length: – Change to character-oriented transmission, if possible.
020	Too many parity errors on the serial interface	ERR LED and DIAG LED on	More than 40 % of the data packets contain parity errors. This can be explained only by a misconfiguration.	Check that the following device settings are correct and match the data to be transmitted: – parity – data bits (7 or 8 bits) – stop bits – data rate
021	Too many stop bit errors on the serial interface	ERR LED and DIAG LED on	More than 40 % of the data packets contain stop bit errors. This can be explained only by a misconfiguration.	Check if the following device settings are correct and match the data to be transmitted: – parity – data bits (7 or 8 bits) – stop bits – data rate
022	Data overload on the SHDSL line	ERR LED and DIAG LED on	At least temporarily, the transmission capacity of the SHDSL line is not large enough. Data can not be moved as quickly on the SHDSL line, as they are received.	– Reduce the serial data rate – If possible, increase the SHDSL data rate
023	Device configuration incompatible/inconsistent	ERR LED and DIAG LED on	The configuration of a neighbor device is not compatible with the configuration of this device.	Configure all devices as it is specified in the relevant configuration wizard.
024	Massive protocol violations on the serial interface	ERR LED and DIAG LED on	On the serial interface there are many too long periods of "zeros". Cause: – Incorrect data rate configured (actual data rate is lower than that of the device). – A short circuit on the serial data line. – If RS-422 or RS-485 is used, a reversed polarity of Line R(N) and R(P) in RS-422 mode or Line D(A) and D(B) in RS-485 mode may be the reason, too.	– Is the correct data rate configured? – Wiring of the serial interface (short circuit?) – A driver of a device connected to the serial port may be defective – In RS-422/RS-485 mode, serial interface signal lines may be interchanged (Reversed polarity in RS-485 or RS-422 mode)

Table 5-1   Diagnostic IDs

No.	Meaning	LED	Possible cause(s)	Remedy
025	Massive noise on the serial interface	ERR LED and DIAG LED on	On the serial interface there are many too short periods of "zeros". Cause: Incorrect data rate configured (actual data rate is higher than that of the device).	Check if the correct data rate is configured.
026	Device initialization error	ERR LED and DIAG LED on	During startup of the device, a defect was detected.	Replace the unit. Please specify the error code in the complaint.
027	Software buffer overflow.	ERR LED and DIAG LED on	Data is received via the SHDSL interface faster as it can be send from the serial port.	If your system works with different serial parameters: set the parameters of all serial interfaces, especially the serial data rate, identical. If the serial parameters are identical: decrease the serial data rate of all serial interfaces or reduce the data load. If RS-232 or RS-422 interfaces are used in a line structure, ensure that they work only in half-duplex mode.
028	Expected SHDSL data rate could not be reached.	ERR LED and DIAG LED on	While the automatic connection sequence, the expected SHDSL data rate could not be achieved. Since the configuration of the device is based on the expected data rate, this can lead to errors.	Check if the settings for the line length and the line diameter are correct. If the settings are correct: read the actual achieved data rate from the device (diagnose) and enter them manually in the configuration assistent. Transfer the modified project to the devices.
086	Low interference	–	Low interference or crosstalk	If interferences occur frequently, check the installation: Check DSL installation: – Check whether the wire pair is connected correctly (twisted pair, star quad stranding). – Check cables for line interruption / short circuit – If available, connect cable shield – Reduce DSL data rate – Reduce external interferences, if possible
087	reserved			

Table 5-1   Diagnostic IDs

No.	Meaning	LED	Possible cause(s)	Remedy
088	Link state changed from "Link partner found" to "Link is down"	–	1. Connector was unplugged while the link was established. 2. Link partner had a power failure. 3. Unfavorable environmental conditions while the link was established (e.g., strong interference). 4. Invalid device configurations Data rate too high	The warning is relevant if there are frequent link aborts, see event no. 5.
089	Link state changed from "Initializing" to "Link is down"	DSL LINK LED pulsing (short flashes every 3 s)	1. Connector was unplugged while the link was established. 2. Link partner had a power failure. 3. Unfavorable environmental conditions while the link was established (e.g., strong interference). 4. Invalid device configurations Data rate too high	The warning is relevant if there are frequent link aborts, see event no. 5.
090	Link state changed from "Link established" to "Link is down"	–	1. Connector was unplugged 2. DSL path was interrupted 3. Power failure at link partner 4. Very high level of interference over a longer period of time	If unintentional link aborts occur frequently, which are not caused by power failures or by disconnection of a line connector. Check DSL installation: – Check whether the wire pair is connected correctly (twisted pair, star quad stranding). – Check cables for line interruption / short circuit – If available, connect cable shield – Reduce DSL data rate – Reduce external interferences, if possible
091	Link quality is good	–	The link quality was specified as "good".	Only relevant when the link quality was "very good" before. If necessary, reduce the data rate if more interference occurs.
092	reserved			
093	reserved			
094	reserved			

Table 5-1   Diagnostic IDs

No.	Meaning	LED	Possible cause(s)	Remedy
095	RS-232 interface no longer connected	–	– The RS-232 line was removed – The connected RS-232 device was removed – Power failure of the connected RS-232 device	Only interesting if the termination of the connection was not intended and the time of the disconnection is to be determined.
096	Sporadic parity errors	–	Sporadically, parity errors occur on the serial interface.	Check the wiring of the serial interface. If the serial data line is relatively long compared to the used data rate, or the quality of the line is not good, reduce the serial data rate.
096	Sporadic stop bit errors	–	Data packets contain sporadic stop bits errors.	Check the wiring of the serial interface. If the serial data line is relatively long compared to the used data rate, or the quality of the line is not good, reduce the serial data rate.
097	Sporadic protocol violations	–	Sporadically there are long periods of "zeros" on the serial interface. Possible cause: – the serial data rate may be configured wrong – there may be a short circuit on the serial data line – a driver of a device connected to the serial port may be defective.	– Check the device configuration (serial data rate correct?) – Check the installation of the serial interface. – If the serial data line is relatively long compared to the used data rate, or the line quality is not good, if applicable reduce the serial data rate
098	Sporadic noise	–	Possible cause: – the serial data rate may be configured wrong – there may be a short circuit on the serial data line – a driver of a device connected to the serial port may be defective.	– Check the device configuration (serial data rate correct?) – Check the installation of the serial interface. – If the serial data line is relatively long compared to the used data rate, or the line quality is not good, if applicable reduce the serial data rate
100	There is no more data received from the remote device(s).	–	For one minute there was no data received from the SHDSL connection. Although data was received previously.	Determining the moment of a communication interruption from the remote device(s).

Table 5-1   Diagnostic IDs

No.	Meaning	LED	Possible cause(s)	Remedy
101	There is no more data received from the serial interface.	–	For one minute there was no data received from the serial interface. Although data was received previously.	Determining the moment of a local communication interruption.
171	No more interferences	–	There has been interference at a port which no longer occurs.	–
172	Information event buffer overrun	–	The logbook for the info events is full (more than 16,000 entries), the oldest info events will be overwritten from now on.	–
173	DSL controller booted	–	The DSL chip was booted successfully. Occurs once after every power-on reset when the device is supplied with 24 V. The DSL chip will not be booted when it is supplied via the USB port only.	–
174	reserved			
175	Link partner found	LINK LED blinking (1 Hz)	The specified DSL port found a link partner.	–
176	Link state changed to "Initializing"	LINK LED blinking (2 Hz)	The specified DSL port changes to the initialization phase.	–
177	Link established	LINK-LED on	The specified DSL port has established a link.	–
178	USB cable connected	–	A USB cable was connected to the device.	–
179	USB cable disconnected	–	A USB cable was disconnected from the device.	–
180	Link quality very good	STAT-LED on	The link quality was specified as "very good".	–
181	No loss of data at the serial interface anymore.	–	Previously, data on the serial interface has been lost. There is no more data loss for one minute.	–
182	Set condition met for DO	–	The set condition is met for the DO.	–
183	Set condition met for DIO	–	The set condition is met for the DIO.	–
184	Set condition not met anymore for DO	–	The set condition is no longer met for the DO.	–
185	Set condition not met anymore for DIO	–	The set condition is no longer met for the DIO.	–

Table 5-1   Diagnostic IDs

No.	Meaning	LED	Possible cause(s)	Remedy
186	Device supplied via USB port only	VCC LED blinking (1 Hz)	This message is generated when the device is supplied via the USB port only. No data traffic may take place, since the DSL chip is reset to save energy.	–
187	DIAG LED set	DIAG LED on	An error event caused the DIAG LED to be set.	–
188	DIAG LED reset	DIAG LED off	The DIAG LED was reset (automatically or manually).	–
189	reserved			
190	No frequent link losses anymore	–	After link losses occurred frequently, the link is stable now (for 10 minutes at least), or the link has been interrupted for 10 minutes at least without having found a link partner.	–
191	reserved			
192	reserved			
193	reserved			
194	reserved			
195	reserved			
196	reserved			
197	reserved			
198	A DTE device is connected to the RS-232 interface.	–	There is a device connected via a 1:1 cable which acts as DTE (corresponds to eg a PC). There is a device connected via a crossover cable which acts as DCE (corresponding to eg a conventional modem).	–
199	A DCE device is connected to the RS-232 interface.	–	– There is a device connected via a 1:1 cable which acts as DCE (corresponding to eg a conventional modem). – There is a device connected via a crossover cable which acts as DTE (corresponds to eg a PC).	–
200	No more too long frames are received.	–	Previously, frames were received which were too long (longer than 500 characters). Since one minute no more too long frames were received.	–

Table 5-1   Diagnostic IDs

No.	Meaning	LED	Possible cause(s)	Remedy
201	Interface receives data	–	The specified serial port receives data. Previously for at least one minute no data was received.	–
202	No more collisions on the RS-485 interface.	–	Previously, there were collisions on the specified serial port. Since one minute no more collisions were detected.	–
203	No more parity errors.	–	Previously, there were parity errors on the specified interface. Since one minute no more parity errors were detected.	–
204	No more stop bit errors.	–	Previously, there were stop bit errors. Since one minute no more stop bit errors were detected.	–
205	No overloading of the SHDSL line anymore.	–	Previously, data loss has occurred due to the overload of a SHDSL line. Since one minute no more data loss was detected.	–
206	Data is received from the SHDSL port.	–	Data is received from the specified SHDSL port and sent to the serial interface. For at least one minute, this has not been the case.	–
207	No more inconsistent device configuration detected.	–	Previously, an inconsistent device configuration has been detected. For one minute, this could not be detected any more. Cause: probably link termination.	–
208	No more noise.	–	Previously, noise has been detected on a serial port. Since one minute there was no more noise detected.	–
209	No protocol violations on the serial interface anymore.	–	Previously, protocol violations were found on a serial interface. Since one minute there were no more protocol violations detected.	–
210	No overflow of the buffer detected.	–	Previously, an overflow in the software buffer has occurred. Since one minute there was no overflow detected.	–