PSI-REP-RS485W2

Repeater for RS-485 2-conductor systems

INTERFACE

Data sheet
102964_en_04

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1 Description

The **PSI-REP-RS485W2** DIN-rail mountable, modular RS-485 repeater is designed to meet the high requirements associated with the use of fieldbus systems. The device is snapped onto standard EN DIN rails in the control cabinet and supplied with 24 V DC. The main areas of application are:

- Electrical isolation/bus segmentation
- Increasing system availability
- Increasing the range
- Increasing transmission speeds
- Extending the number of devices to n x 32
- Implementing hybrid/network structures
- Modular star couplers

The repeater can be used universally in all common 2-conductor bus systems (RS-485W2).

The following features of the repeater are particularly outstanding:

- Supports all bus systems with UART/NRZ data format and 10/11-bit character length
- Transmission speed of 4.8 kbps to 500 kbps
- Automatic transmit/receive changeover
- Integrated, connectable termination resistors
- High-quality 4-way isolation
- 24 V DC control cabinet supply voltage
- User-friendly connection via COMBICON plug-in screw terminals
- Bit retiming
- Bit oversampling
- Modular station structure, even with PSI-MOS-... fiber optic converters

1.1 Bit retiming

RS-485 signals with a bit distortion of up to 35% can be reliably detected using the bit retiming function and are converted to their original bit form before being transferred to the next segment. This data processing function means that a virtually unlimited number of repeaters can be aligned without an impermissible level of bit distortion.

1.2 Bit oversampling

The bit oversampling function can be used to detect and filter malfunctions so that they are not transferred to the next segment.

If you have any technical problems, which you cannot resolve with the aid of this documentation, please contact us during the usual office hours at:

Phone: + 49 5235 3-19890
Fax: + 49 5235 3-30999
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Make sure you always use the latest documentation.
This can be downloaded at www.phoenixcontact.net/catalog.

This data sheet is valid for the products listed on the following page:

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2 Ordering data

Repeater

Description	Type	Order No.	Pcs./Pkt.
RS-485 repeater, for electrical isolation and increasing the range in RS-485 2-conductor bus systems, 4-way isolation, DIN-rail mountable	PSI-REP-RS485W2	2313096	1

Accessories

Description	Type	Order No.	Pcs./Pkt.
System power supply unit for supplying a modular star coupler topology	MINI-SYS-PS 100-240AC/24DC/1.5	2866983	1
System power supply unit for supplying a modular star coupler topology, for potentially explosive areas	MINI-PS-100-240AC/24DC/1.5/EX	2866653	1
End clamps	CLIPFIX 35	3022218	50
DIN rail connector, power supply and data (2 per device)	ME 17.5 TBUS 1.5/ 5-ST-3.81 GN	2709561	10

3 Technical data

Interface	
Supply	24 V DC (±20% via COMBICON plug-in screw terminal block)
Frequency	DC
Nominal current consumption	75 mA (at 24 V DC)
Ready-to-operate indicator	"VCC" LED (green)
Maximum star coupler expansion	10
Serial RS-485 interface	In acc. with EIA/TIA-485, DIN 66259-4/RS-485 2-conductor
Transmission channels	2 (1/1), TD, RD
Operating mode	Half duplex
Data format/encoding	UART (11/10-bit switchable, NRZ)
Data direction changeover	Automatic, minimum station response time 2 bits
Transmission speed (manual adjustment)	4.8/ 9.6/ 19.2/ 38.4/ 57.6/ 75/ 93.75/ 115.2/ 136/ 187.5/ 375/ 500 kbps
Transmission length	1200 m, maximum (depending on transmission speed, bus system, and cable type)
Transmission medium	2-conductor twisted pair, shielded
Termination resistor	390 Ω – 150 Ω – 390 Ω (can be connected to port A and B)
Connection	COMBICON plug-in screw terminal block

General data	
Bit distortion input	±35%, maximum
Bit distortion output	< 6.25%
Bit delay	≤ 1 bit
Electrical isolation	RS-485 (A) // RS-485 (B) // Supply // DIN rail connector
Test voltage	1.5 kV_{rms}, 50 Hz, 1 min.
Status and diagnostic indicators	Power supply (VCC), transmit/receive data (port A)
Housing material	PA V0, green
Conductor cross-section	0.2 mm^2 to 2.5 mm^2
Ambient temperature	
Operation	-20 °C to +60 °C
Storage/transport	-40 °C to +85 °C
Humidity	10% to 95%, no condensation
Dimensions (W x H x D)	35 mm x 99 mm x 105 mm
Degree of protection	IP20
Weight	200 g, approximately
MTBF according to Telcordia standard	
Ambient temperature 25 °C	1247 years
Ambient temperature 40 °C	261 years
Check for substances which can affect the paint wetting	Free from substances that could affect coating with paint or varnish (according to VW/Audi/Seat specification VW PV-3.10.7)
Vibration resistance	5g according to IEC 60068-2-6, 2.5 h each in x, y, and z direction, criterion A
Shock resistance	15g according to IEC 60068-2-27 with 11 ms pulse length, criterion C
Free fall	1 m without packaging according to IEC 60068-2-32
Air and creepage distances	DIN EN 50178, DIN EN 60950

Tests/approvals	
CE	CE
UL/CUL 508	c UL us UL 508/C-UL 508
Ex	Ex II 3G Ex nA II T4 X

Conformance with EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC

Noise immunity test according to EN 61000-6-2[1]

Electrostatic discharge (ESD)	EN 61000-4-2	Criterion B[2]	
Air discharge			8 kV
Contact discharge			6 kV
Electromagnetic HF field	EN 61000-4-3	Criterion A[3]	
Amplitude modulation			10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion B[2]	
Signal			2 kV/5 kHz
Supply			2 kV/5 kHz
Surge current load (surge)	EN 61000-4-5	Criterion B[2]	
Signal			1 kV/12 Ω
Supply			0.5 kV/2 Ω
Conducted interference	EN 61000-4-6	Criterion A[3]	10 V, 80% AM 1 kHz

Noise emission test according to EN 61000-6-4

Noise emission of housing	EN 55011[4]	Class A[5]

[1] EN 61000 corresponds to IEC 61000

[2] Criterion B: Temporary adverse effects on the operating behavior, which the device corrects automatically.

[3] Criterion A: Normal operating behavior within the specified limits.

[4] EN 55011 corresponds to CISPR11

[5] Class A: Industrial application, without special installation measures.

Block diagram

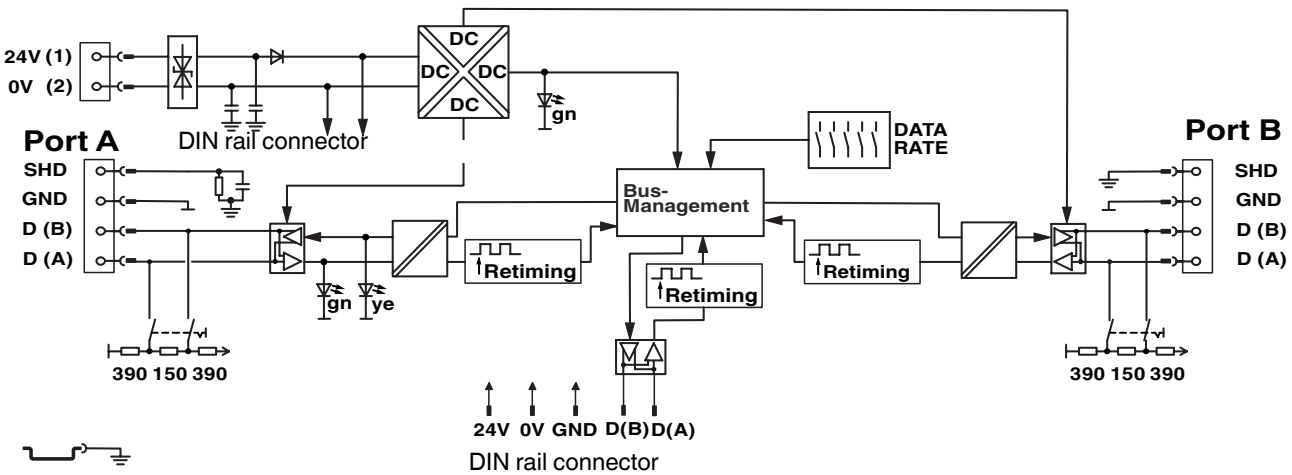


Figure 1 Block diagram

Housing dimensions

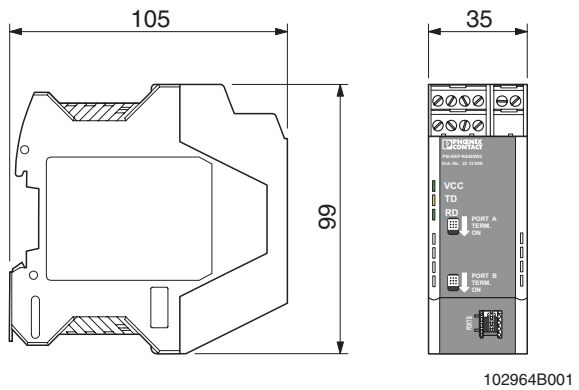


Figure 2 Housing dimensions (in mm)

4 Safety regulations and installation notes

4.1 Installation and operation

Follow the installation instructions.

NOTE: Installation, operation, and maintenance may only be carried out by qualified specialist personnel.

When installing and operating the device, the applicable safety directives (including national safety directives), accident prevention regulations, as well as general technical regulations must be observed.

NOTE: The device must not be opened or modified apart from the configuration of the DIP switches.

NOTE: The switches that can be accessed may only be actuated when the power supply to the device is disconnected.

Do not repair the device yourself, replace it with an equivalent device. Repairs may only be carried out by the manufacturer.

NOTE: The IP20 degree of protection (IEC 60529/EN 60529) of the device is intended for use in a clean and dry environment. The device must not be subjected to mechanical strain and/or thermal loads, which exceed the limits described.

WARNING: The PSI-REP-RS485W2 module is designed for SELV operation according to IEC 60950/EN 60950/VDE 0805.

The module may only be connected to devices which meet the requirements of EN 60950.

For safety data, please refer to the operating instructions and certificates (EC type-examination certificate, other approvals, if necessary).

4.2 Installation in zone 2

WARNING: Explosion hazard

The device is designed for installation in zone 2 potentially explosive areas.

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.

Observe the requirements of EN 60079-14.

WARNING: Explosion hazard

Disconnect the block power supply **before**:

– Snapping it on or disconnecting it
– Connecting or disconnecting cables

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 supply and signal circuits in zone 2.

WARNING: Explosion hazard

The device must be stopped and immediately removed from the Ex area if it is damaged or was subjected to an impermissible load or stored incorrectly or if it malfunctions.

Installation in areas with a danger of dust explosions

WARNING: Explosion hazard

The device is **not** designed for use in areas with a danger of dust explosions.

If dust is present, install the device in suitable, approved housing.

5 Applications

The PSI-REP-RS485W2 repeater can be used to create network topologies that are perfectly adapted to the relevant application.

The limits set by standard RS-485, which specifies the electrical properties of bus interfaces, are thus extended. Standard RS-485 defines the following basic specifications:

– Maximum of 32 devices per potential segment
– Only (linear) bus structure permitted
– Maximum bus cable length of 1200 m
– Maximum branch line length of 5 m without termination resistor
– Bus cable termination only at the start and end of the bus cable

Data rate:	< 187.5 kbps	≥ 187.5 kbps	500 kbps
Segment length:	1200 m	1000 m	400 m

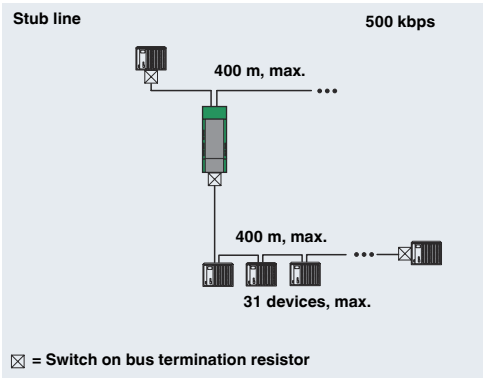
Example applications for repeaters

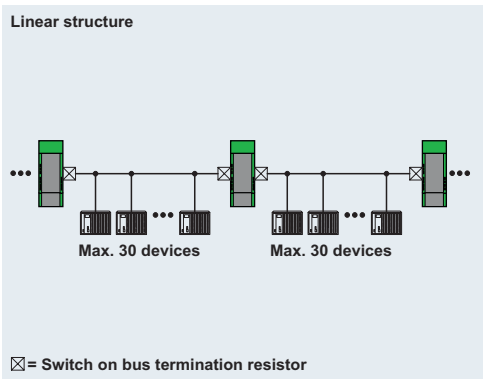
A segment can be created as an active branch, which can comprise the full bus cable length and a maximum of 31 devices.

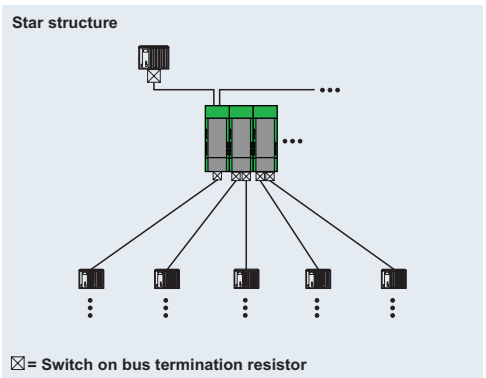
Electrical isolation and bus segmentation using repeaters enables the permissible bus cable length to be multiplied and the number of devices to be extended to n x 32, since the total number of devices of the RS-485 specification applies in each potential segment.

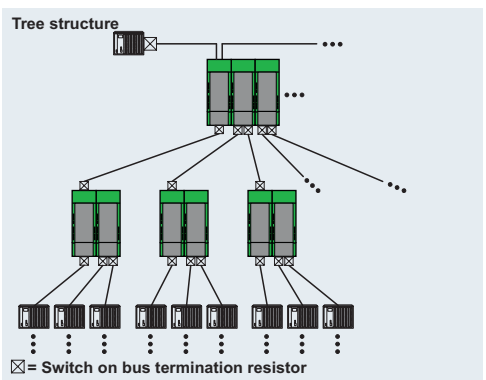
The repeater supports higher transmission speeds by subdividing into shorter segment lengths.

Hybrid/network structures, star, and tree structures can be created using the PSI-REP-RS485W2 modular repeater. A freely selectable installation concept, independent of the restrictive linear structure, is thus possible. Repeaters can be combined to create modular star couplers and this type of star coupler can be extended with PSI-MOS-RS485W2... FO converters to create RS-485 2-conductor systems.









6 Function elements

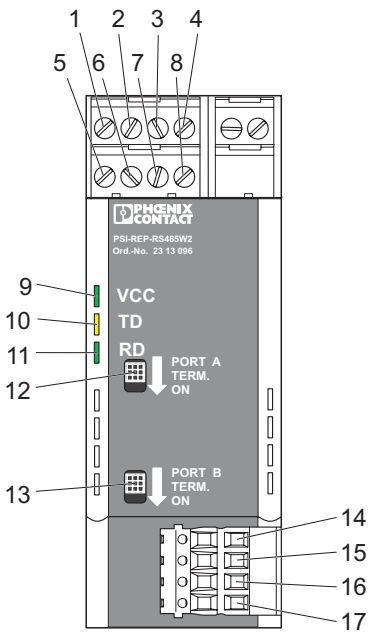


Figure 3 Function elements

1 24 V DC supply voltage connection
2 0 V DC supply voltage connection
3 not assigned
4 not assigned
5 SHD, shield and strain relief
6 GND
7 D(B) transmit/receive positive (port A)
8 D(A) transmit/receive negative (port A)
9 "VCC" LED
10 "TD" LED
11 "RD" LED
12 Bus termination switch port A
13 Bus termination switch port B
14 D(A) transmit/receive negative (port B)
15 D(B) transmit/receive positive (port B)
16 GND
17 SHD, shield and strain relief

Diagnostic and status indicators

Des.	Color	Meaning
VCC	Green	Ready-to-operate
TD	Yellow	Transmit data dynamic port A
RD	Green	Receive data dynamic port A

7 DIP switch

NOTE: Electrostatic discharge

The device contains components that can be damaged or destroyed by electrostatic discharge. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5.

The DIP switches are located under the cap on the port B interface (see Figure 4).

- Insert a small screwdriver into the small recess on the bottom of the cap and lever it off.

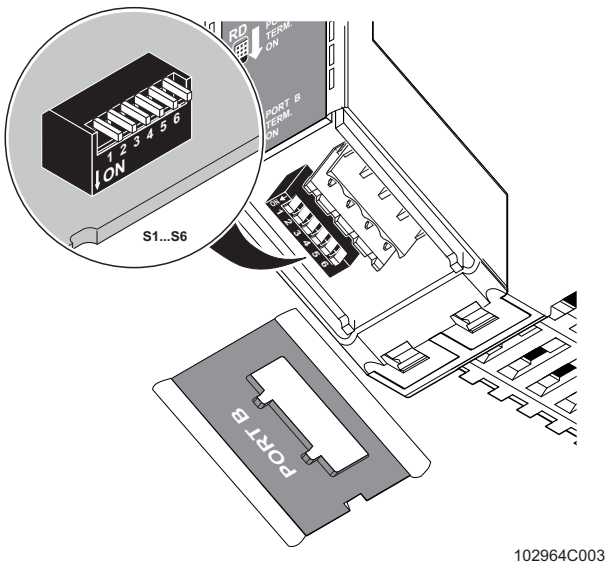


Figure 4 DIP switches

The tables in Section 7.1 and 7.2 provide an overview of the DIP switch functions. By default upon delivery, all DIP switches are in the "OFF" position.

7.1 Setting the transmission speed

- Set the transmission speed using DIP switches 1 to 4

Transmission speed (kbps)	DIP switch			
	1	2	3	4
500	OFF	OFF	OFF	OFF
375	OFF	OFF	OFF	**ON**
187.5	OFF	OFF	**ON**	OFF
136	OFF	OFF	**ON**	**ON**
115.2	OFF	**ON**	OFF	OFF
93.75	OFF	**ON**	OFF	**ON**
75	OFF	**ON**	**ON**	OFF
57.6	OFF	**ON**	**ON**	**ON**
38.4	**ON**	OFF	OFF	OFF
19.2	**ON**	OFF	OFF	**ON**
9.6	**ON**	OFF	**ON**	OFF
4.8	**ON**	OFF	**ON**	**ON**

7.2 10/11-bit selection (DIP 5)

Please always observe the UART character word length specified by the control system manufacturer.

The standard word length of a UART character is 11 bits. If operating Modbus in RTU mode, you can leave DIP 5 in the "OFF" position.

However, some bus systems, e.g., Modbus in ASCII mode, transmit 10-bit word lengths.

- Set DIP switch 5 to the "ON" position (= 10-bit).

DIP switch	ON	OFF
5	10-bit	11-bit
6	not assigned	

8 Connection notes

WARNING: Only mount and remove devices when the power supply is disconnected.

WARNING: The PSI-REP-RS485W2 module is designed for SELV operation according to IEC 60950/EN 60950/VDE 0805.

The module may only be connected to devices which meet the requirements of EN 60950.

- Install the device on a 35-mm DIN rail according to DIN EN 60715.

  To avoid contact resistance only use clean, corrosion-free DIN rails.
- End clamps can be mounted on both sides of the device to stop the devices from slipping on the DIN rail (for ordering data see Page 2).

WARNING: Connect the DIN rail to protective earth ground with a grounding terminal block. The devices are grounded when they are snapped onto the DIN rail (installation according to PELV).

This ensures that the shielding is effective. Connect to protective earth ground with low impedance.

8.1 Combined assembly with a system power supply unit (modular star coupler)

- Connect together the required number of DIN rail connectors for the connection station.

  Two DIN rail connectors are required for each device (see A in Figure 5).

  A maximum of ten devices are permitted in a connection station.
- Push the connected DIN rail connectors onto the DIN rail (B and C).
- Place the device onto the DIN rail from above. The upper holding keyway of the device must be hooked onto the top edge of the DIN rail (see Figure 6).

  Make sure that it is aligned correctly with the DIN rail connectors.
- Once the device has been snapped on properly, check that it is fixed securely on the DIN rail.

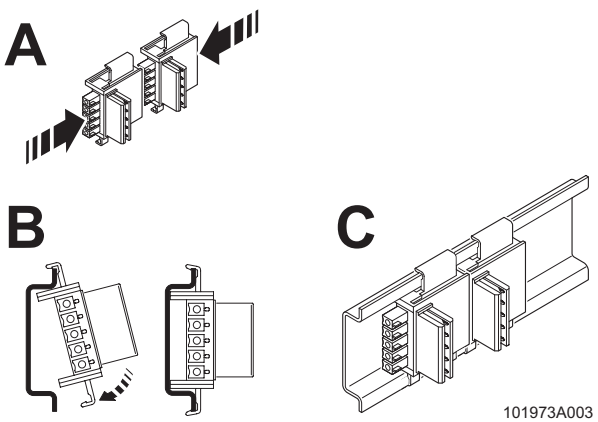


Figure 5 Combined assembly

8.2 Installation as a stand-alone device in the control cabinet

- Place the device onto the DIN rail from above. The upper holding keyway of the device must be hooked onto the top edge of the DIN rail (see Figure 6).
- Push the device from the front towards the mounting surface.
- Once the device has been snapped on properly, check that it is fixed securely on the DIN rail.

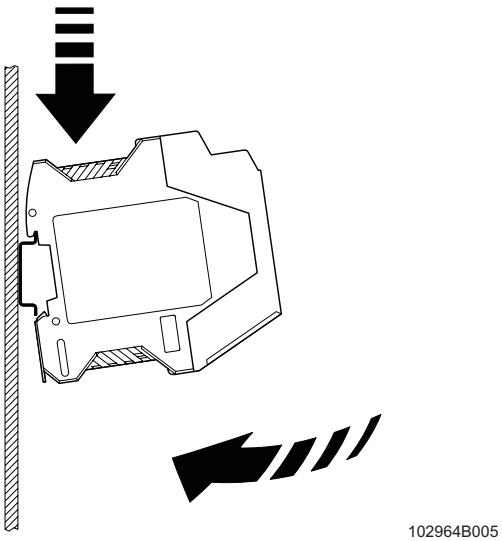


Figure 6 Installation in the control cabinet

8.3 Installation in potentially explosive areas

WARNING: Observe the safety notes on Page 6.

– Areas with a danger of gas explosions
  Only devices that are installed in zone 2 may be connected to the data interfaces (port A and B).
– Areas with a danger of dust explosions
  If dust is present, install the device in suitable, approved housing.

8.4 Removal

- Pull the locking latch down using a screwdriver, needle-nose pliers or similar.
- Pull the bottom edge of the module away from the mounting surface.
- Pull the module diagonally upwards away from the DIN rail.
- If removing a complete star distributor, remove the DIN rail connectors from the DIN rail as well.

9 Cabling notes

9.1 Connecting the supply voltage

WARNING: The device is operated with a +24 V DC SELV.

Operation as an individual device

Supply the supply voltage to the module via terminal blocks 1 (24 V) and 2 (0 V).

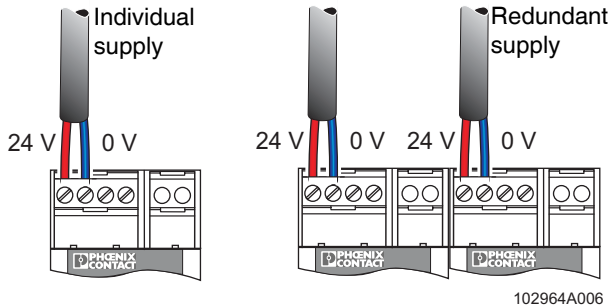


Figure 7 Individual/redundant supply

Operation in a star coupler topology

When the devices are operated in a star coupler topology, the supply voltage must only be supplied to the first device in the station. The remaining devices are supplied via the DIN rail connector. A redundant supply concept can be created by connecting a second power supply unit to another device in the topology.

Using the MINI POWER system power supply unit

As an alternative, the star coupler topology can also be supplied using the
MINI-SYS-PS 100-240AC/24DC/1.5 (Order No. 2866983) or MINI-PS-100-240AC/24DC/1.5/EX (Order No. 2866653) system power supply unit. It is connected via two DIN rail connectors.

Usually the system power supply unit is mounted as the first device in a topology. A second power supply unit can be used to create a redundant supply concept.

9.2 Connecting the data cables

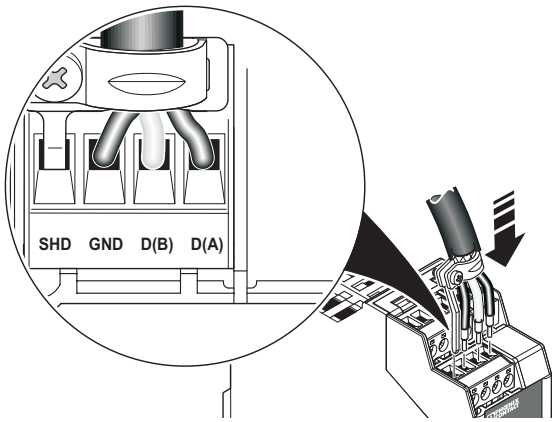


Figure 8 Data cable connection (port A)

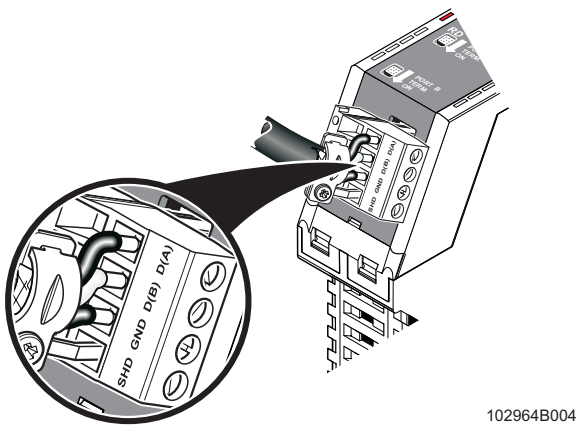


Figure 9 Data cable connection (port B)

NOTE: Use shielded twisted pair data cables. Connect the cable shielding at both ends of the transmission path.

- Connect the data cables and the data cable shield to the corresponding contacts on the COMBICON connector. For optimum shield connection use the terminal clamp provided.
- If the repeater is located at the start or end of an electrical RS-485 segment, activate bus termination on the top of the device.

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