Ethernet extender

User manual

UM EN TC EXTENDER...

PHOENIX CONTACT
INSPIRING INNOVATIONS

User manual

Ethernet extender

UM EN TC EXTENDER..., Revision 01 2022-09-12

This user manual is valid for:

Designation	Firmware version	Item No.
TC EXTENDER 2001 ETH-2S	5.xx	2702409
TC EXTENDER 4001 ETH-1S	5.xx	2702253
TC EXTENDER 6004 ETH-2S	5.xx	2702255

108102_en_01

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phoenixcontact.com

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1 For your safety

Read this user manual carefully and keep it for future reference.

1.1 Identification of warning notes

This symbol indicates hazards that could lead to personal injury.

There are three signal words indicating the severity of a potential injury.

DANGER
Indicates a hazard with a high risk level. If this hazardous situation is not avoided, it will result in death or serious injury.

WARNING
Indicates a hazard with a medium risk level. If this hazardous situation is not avoided, it could result in death or serious injury.

CAUTION
Indicates a hazard with a low risk level. If this hazardous situation is not avoided, it could result in minor or moderate injury.

This symbol together with the **NOTE** signal word warns the reader of actions that might cause property damage or a malfunction.

Here you will find additional information or detailed sources of information.

1.2 Qualification of users

The use of products described in this user manual is oriented exclusively to electrically skilled persons or persons instructed by them.

- The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.
- The user must be familiar with the use of Ethernet network components.

When using Ethernet network components, there is a danger of data conflicts due to fault conditions and a hazard to the data and network integrity due to unauthorized data access. If in doubt, consult an Ethernet network specialist to assess the use of the devices and the set configuration.

1.3 Field of application of the product

1.3.1 Intended use

The TC EXTENDER... makes broadband Ethernet applications on existing cables possible. You can use the Ethernet extenders for in-house 2 and 4 wire cables, but not in the public telephone network. You can establish point-to-point, line, or ring structures with ranges of up to 20 km.

You can use the Ethernet extender in a network with predecessor-generation devices (PSI-MODEM-SHDSL/ETH from firmware version 4.xx, Item No. 2313643). This allows central diagnostics to be performed for all users and lines via IP.

1.3.2 Product changes

Modifications to the device hardware or firmware are **not** permitted.

Incorrect operation or modifications to the device can endanger your safety or damage the device. Do not repair the device yourself. If the device is defective, please contact Phoenix Contact.

Updating the firmware is permitted. You will find the respective latest firmware version on the product page at phoenixcontact.net/products.

1.4 Safety notes

WARNING:
Observe the following safety notes when using the device.

- The category 3 product is designed for installation in zone 2 potentially explosive areas. It satisfies the requirements of the following standards:
  - EN/IEC 60079-0, EN/IEC 60079-7
  - You will find detailed information in the declarations of conformity, which are enclosed and are also available on our website in the latest version.
- Installation, operation, and maintenance may only be carried out by qualified electricians. Follow the installation instructions as described.
- When installing and operating the device, the applicable regulations and safety directives (including national safety directives), as well as general technical regulations, must be observed. The safety-relevant data is listed in this document.
- Observe the specified conditions for use in potentially explosive areas.
- Also observe the requirements of EN 60079-14.
- Opening or modifying the product is prohibited. Do not repair the product yourself; replace it with an equivalent product instead. Repairs may only be carried out by the manufacturer. The manufacturer is not liable for damage resulting from non-compliance.
- Do not subject the product to mechanical and/or thermal stress that exceeds the specified limits.
- The product must be stopped and immediately removed from the Ex area if it is damaged, has been subjected to an impermissible load, stored incorrectly, or if it malfunctions.
- The product is not designed for use in potentially dust-explosive atmospheres.
- The device is designed exclusively for operation with SELV/PELV from a Class ES1 “electrical energy source” in accordance with EN/IEC 62368-1 and VDE 0868-1. The device may only be connected to devices that meet the requirements of class ES1 in accordance with EN/IEC 62368-1.

1.5 Installation in zone 2

1.5.1 TC EXTENDER 2001 ETH-2S

WARNING: Explosion hazard when used in potentially explosive areas!
Make sure that the following notes and instructions are observed and complied with.

- Use in potentially explosive areas is **not** permitted in China.
- The device should be installed so that at least IP54 degree of protection is achieved in accordance with EN 60529. To this end, a suitable, approved housing that meets the requirements of EN 60079-7 should be used.
- Only devices which are designed for operation in Ex zone 2 and are suitable for the conditions at the installation location may be connected to the circuits in the Ex zone.
- In potentially explosive areas, terminals may only be snapped onto or off the DIN rail connector and wires may only be connected or disconnected when the power is switched off.
- The configuration interface may only be used if it has been ensured that there is no potentially explosive atmosphere present.
- For safe operation, lockable plug connections must have a functional interlock (e. g. locking clip, screw connection etc.). Insert the interlock. Repair any damaged connectors immediately.
- Only operate the device in Ex zone 2 when all plugs are fully inserted.
- Only connect one cable per terminal point.
- Use the device in an environment that does not exceed pollution degree 2 in accordance with EN/IEC 60664-1.
- Use transient protection so that short-term surge voltages do not exceed 119 V.

1.5.2 TC EXTENDER 4001 ETH-1S and TC EXTENDER 6004 ETH-2S

WARNING: Explosion hazard when used in potentially explosive areas!
Make sure that the following notes and instructions are observed and complied with.

- Use in potentially explosive areas is **not** permitted in China.
- The device should be installed so that at least IP54 degree of protection is achieved in accordance with EN 60529. To this end, a suitable, approved housing that meets the requirements of EN 60079-7 should be used.
- Only devices which are designed for operation in Ex zone 2 and are suitable for the conditions at the installation location may be connected to the circuits in the Ex zone.
- In potentially explosive areas, only snap the device onto or off the DIN rail or connect and disconnect the cables when the power is disconnected.
- For safe operation, lockable plug connections must have a functional interlock (e. g. locking clip, screw connection etc.). Insert the interlock. Repair any damaged connectors immediately.
- Only connect one cable per terminal point.
- Replace the SD card only when the power is disconnected or when an explosive atmosphere is not present.
- Between the DSL connection, U_B, and FE, surge protective devices discharge interference < 500 V_{rms}.
- Only operate the device in Ex zone 2 when all plugs are fully inserted.
- Use the device in an environment that does not exceed pollution degree 2 in accordance with EN/IEC 60664-1.
- Use transient protection so that short-term surge voltages do not exceed 119 V.
- The device must be installed upright in Zone 2.
- A distance of 40 mm must be maintained from external sources of heat.
- Before measuring the insulation, disconnect the plugs for the DSL cables and power supply. Otherwise, inaccurate measurements may occur. Reinsert the plugs once the insulation measurement has been completed.

1.6 UL notes

1.6.1 TC EXTENDER 2001 ETH-2S

INDUSTRIAL CONTROL EQUIPMENT 11AE
Wire Range: 24-14 AWG
Cu Copper Wire, 60/75C
Terminal tightening torque value: 5-7 (Lbs-Ins)
Environmental designation: "Open Type Device"
"Pollution Degree 2 Installation Environment"

1.6.2 TC EXTENDER 4001 ETH-1S and TC EXTENDER 6004 ETH-2S

INDUSTRIAL CONTROL EQUIPMENT 11AE
Wire Range: 24-16 AWG
Cu Copper Wire, 60/75C
Terminal tightening torque value: 5-7 (Lbs-Ins)
Environmental designation: "Open Type Device"
"Pollution Degree 2 Installation Environment"

1.7 Security in the network

NOTE: Risk of unauthorized network access
Connecting devices to a network via Ethernet entails the risk of unauthorized access to the network.
Observe the following safety notes!

- If possible, deactivate unused communication channels.
- Assign passwords so that third-parties cannot access the device and make unauthorized changes.
- Due to its communication interfaces, the device should not be used in safety-critical applications unless additional security appliances are used. Please take additional protective measures in accordance with the IT security requirements and the standards applicable to your application (e.g., virtual networks (VPNs) for remote maintenance access, firewalls, etc.) for protection against unauthorized network access.
- On first request, you shall release Phoenix Contact and the companies associated with PHOENIX CONTACT GmbH & Co. KG, Flachsmarktstrasse 8, 32825 Blomberg, Germany in accordance with §§15ff. AktG (German Stock Corporation Act), hereinafter collectively referred to as “Phoenix Contact”, from all third-party claims made due to improper use.
- For the protection of networks for remote maintenance via VPN, Phoenix Contact offers the mGuard product series of security appliances, which you can find described in the latest Phoenix Contact catalog (phoenixcontact.net/products).
- Additional measures for protection against unauthorized network access can be found in the AH EN INDUSTRIAL SECURITY application note. The application note can be downloaded from the item page at phoenixcontact.net/product/2702409.

1.7.1 Brief Ethernet network information

The Unmanaged extenders do not have their own IP address. They are transparent for the network.

The Managed extenders have their own IP address.

– Delivery state: Alternating BootP/DHCP client
– State after reset using the 2-2-5 method (see page 60):
  – IP address: 192.168.0.254
  – Subnet mask: 255.255.255.0

- If you use SNMP, RSTP, or VLAN, you will need special knowledge of the secure operation of Ethernet networks.
- Ensure that you avoid data conflicts and that the data integrity is safeguarded.

2 Transport, storage, and unpacking

2.1 Transport

The device is delivered in cardboard packaging.

- Only transport the device to the intended location in its original packaging.
- Please observe the notes on handling on the packaging.
- Observe the humidity specifications and the temperature range specified for transport (see “Ambient conditions” on page 100).
- Protect the surfaces as necessary to prevent damage.
- When transporting the equipment or storing it temporarily, make sure that the surfaces are protected from the elements and any external influences, and that they are kept dry and clean.

2.2 Storage

The storage location must meet the following requirements:

– Dry
– Protected from unauthorized access
– Protected from harmful environmental influences such as UV light

- For storage, observe the humidity and air pressure specifications, and the temperature range.

– See “Ambient conditions” on page 100.

2.3 Checking the delivery

The device is supplied in the packaging together with a packing slip and installation instructions.

- Read the complete packing slip carefully before unpacking the device.
- Retain the packing slip.

NOTE: Electrostatic discharge

Electrostatic discharge can damage or destroy components.

– When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) in accordance with EN 61340-5-1 and IEC 61340-5-1.

Checking the delivery

- Check the delivery for transport damage.

Damaged packaging is an indication that transit damage may have occurred. This could result in a malfunction.

- Immediately upon delivery, check the delivery note to ensure that the delivery is complete.
- Submit claims for any transport damage immediately, and inform Phoenix Contact or your supplier as well as the shipping company without delay.
- Enclose photos clearly documenting the damage to the packaging and/or delivery together with your claim.
- Keep the box and packaging material in case you need to return the product.
- We strongly recommend using the original packaging to return the product.
- If the original packaging is no longer available, observe the following points:
  – Observe the humidity specifications and the temperature range specified for transport (see “Ambient conditions” on page 100).
  – Use dehumidifying agents if necessary.
  – Use suitable ESD packaging to protect components that are sensitive to electrostatic discharge.
  – Make sure that the packaging you select is large enough and sufficiently thick.
  – Only use plastic bubble wrap sheets as wadding.
  – Attach warnings to the transport packaging so that they are clearly visible.
  – Please ensure that the delivery note is placed inside the package if the package is to be shipped domestically. However, if the package is being shipped internationally, the delivery note must be placed inside a delivery note pocket and attached to the outside so that it is clearly visible.

3 Product description

With Ethernet extenders, you can connect Ethernet networks over distances up to 20 kilometers via simple 2-wire cables. You can combine Managed and Unmanaged Ethernet extenders in the same network. This combination and easy startup using Plug and Play enable cost-effective networking and diagnostics of all devices and paths via IP.

Features

- Automatic topology and data rate detection saves time and money
- Redundancy by means of RSTP (Rapid Spanning Tree Protocol)
- VLAN (Virtual Local Area Network) for logically separated IP networks
- Flexible use
  - Point-to-point with double the bandwidth in 4-wire operation
  - Line and ring topology with up to 50 devices
- Protocol-transparent transmission of all standard protocols:
  - EtherNet/IP™
  - Modbus/TCP
  - PROFINET
  - PROFIsafe
  - EtherCAT®
  - KNX
  - BACnet/IP
  - and more

Table 3-1 Product variants

Designation	Item No., link	Description		Topologies
TC EXTENDER 2001 ETH-2S	2702409	Unmanaged		Point-to-point, line, ring
TC EXTENDER 4001 ETH-1S	2702253	Managed	1-port Ethernet Switch, 1 DSL port, LEDs	Point-to-point
TC EXTENDER 6004 ETH-2S	2702255		4-port Ethernet Switch, 2 DSL ports, display	Point-to-point, line, ring

3.1 Unmanaged Ethernet extender

The Unmanaged Ethernet extender allows easy startup via Plug and Play. The system can be extended during operation without causing any adverse impact. Unlike the Managed extender, the Unmanaged extender is transparent for the Ethernet network.

The device does not have its own IP address. It is not necessary to configure the network or the IP addresses.

3.2 Managed Ethernet extender

Remote diagnostics via IP

With the Managed Ethernet extenders, you can diagnose all devices and paths centrally via IP. There are two options available for remote diagnostics:

– Web-based, via the web server on the device
– Via SNMP using separate software, e.g., an MIB browser (not supplied as standard)

SNMP

In the web-based management, activate the SNMP traps. You can send the following event messages:

– Device start
– Ethernet connection status changed
– DSL connection status changed
– Surge protection status changed
– DSL ring error
– User access data (admin) changed
– SD card has been inserted or removed

High-quality surge protection

PLUGTRAB PT-IQ is the forward-looking surge protection system from Phoenix Contact. Your advantage: multi-stage monitoring of protective devices. This means that failures can be foreseen.

– Integrated, replaceable SHDSL surge protection
– Automatic notification when replacement threshold reached or in the event of overload

3.3 Functions in firmware version 5.xx

Virtually separate critical IP networks with VLAN

All Ethernet extenders in the TC EXTENDER... product family support VLAN (Virtual Local Area Network).

VLAN enables you to separate physical networks into logical subnetworks. Communication is then only possible within the corresponding VLAN. Critical IP networks are isolated in this way and communication is more secure.

Configure the VLAN manually as you usually would or with the support of a software assistant.

If a device fails, you can replace it by means of Plug and Play. However, to do this, the newly inserted device must be in the delivery state. The newly inserted device then automatically adopts the entire configuration of the device it replaces.

Possible VLAN system operation:

– Managed extenders only, configuration via web-based management
– Mixed operation of Unmanaged and Managed extenders, configuration via web-based management
– Unmanaged extenders only, configuration via PSI-CONF software

Following configuration with PSI-CONF, you can use the VLAN functions in the Ethernet network. However, the Unmanaged extenders are **not** visible with an IP address.

High availability thanks to RSTP redundancy

The Managed extenders support RSTP (Rapid Spanning Tree Protocol).

RSTP enables you to set up redundant ring or point-to-point topologies. The protocol automatically disables duplicate or failed paths, thereby increasing network availability.

If a device fails, you can replace it by means of Plug and Play. However, to do this, the newly inserted device must be in the delivery state. The newly inserted device then automatically adopts the entire configuration of the device it replaces.

RSTP telegrams can also be transmitted in a network that only consists of Unmanaged extenders. However, you must operate the devices in hub mode.

- If the network only consists of Unmanaged extenders: deactivate switch mode in the PSI-CONF software (IP Address Learning = active).

In mixed operation with Managed extenders, switch mode is automatically deactivated as soon as you activate RSTP. However, to do this, all devices in the extender network must already be connected to each other.

Greater transparency during diagnostics

The Managed extenders support SNMP (Simple Network Management Protocol).

For mixed operation of Unmanaged and Managed extenders, you can also read the status of the Unmanaged extenders via SNMP (see 6.5.5 “Diagnostics via SNMP”).

Even more system events can be detected with the help of this function extension. You can send alarm messages and diagnose system events via SNMP. This makes the communication network more transparent. In the event of malfunctions or tampering attempts, you can initiate countermeasures quickly.

In conjunction with an MIB browser, the states of all Unmanaged extenders are also displayed via the IP address of the Managed extender. However, the Unmanaged extenders do not have their own IP address in the network.

Along with the firmware update, it may be necessary under certain circumstances to also update the MIB file in the MIB browser.

You will find the FW5.xx update package with the file EXTENDER_Private.MIB on our website at phoenixcontact.net/product/2702255.

3.4 Application examples

Figure 3-1 IP communication via any two-wire cables up to 20 km

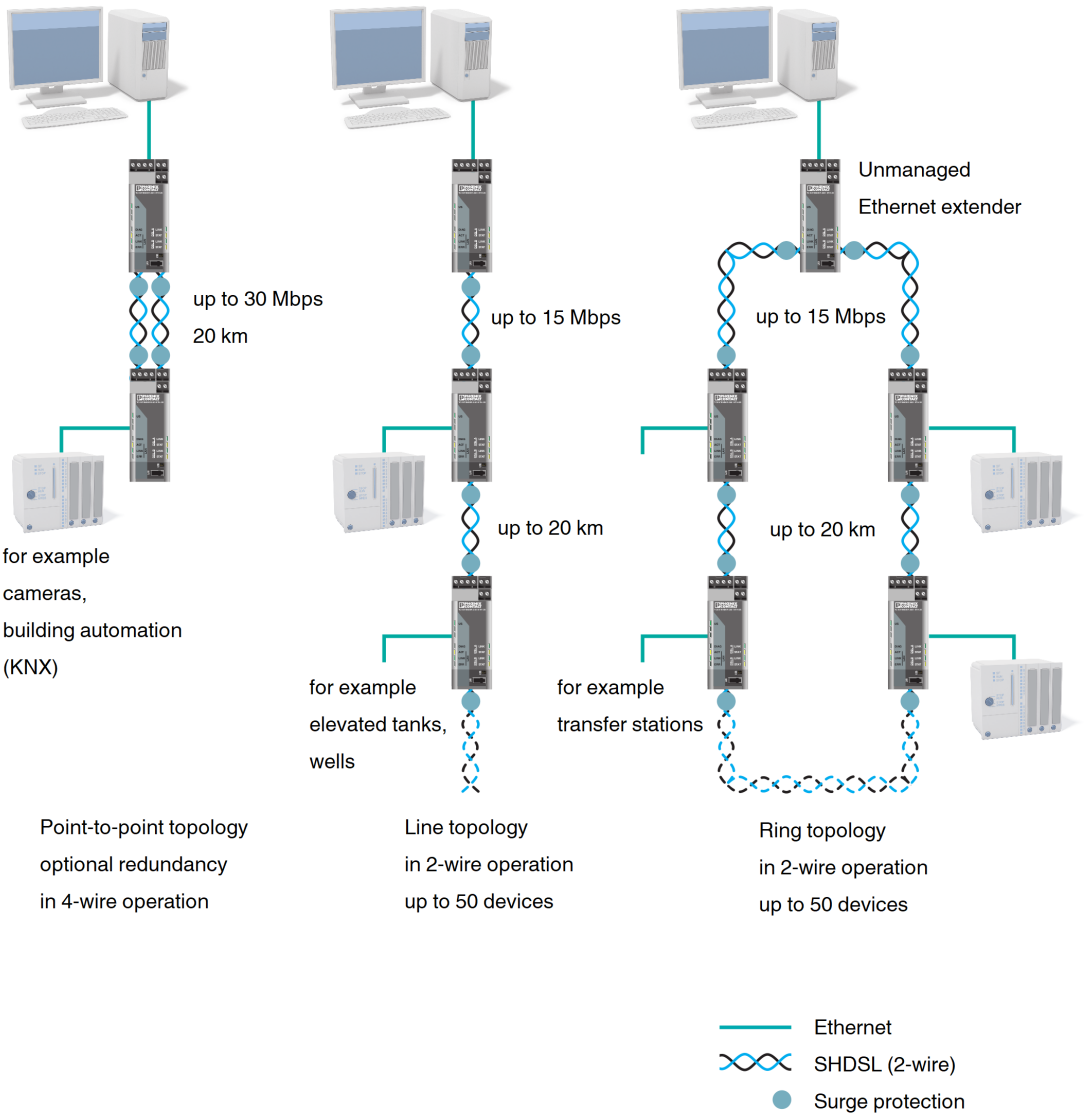


Figure 3-2 Easy connection and monitoring of large IP networks

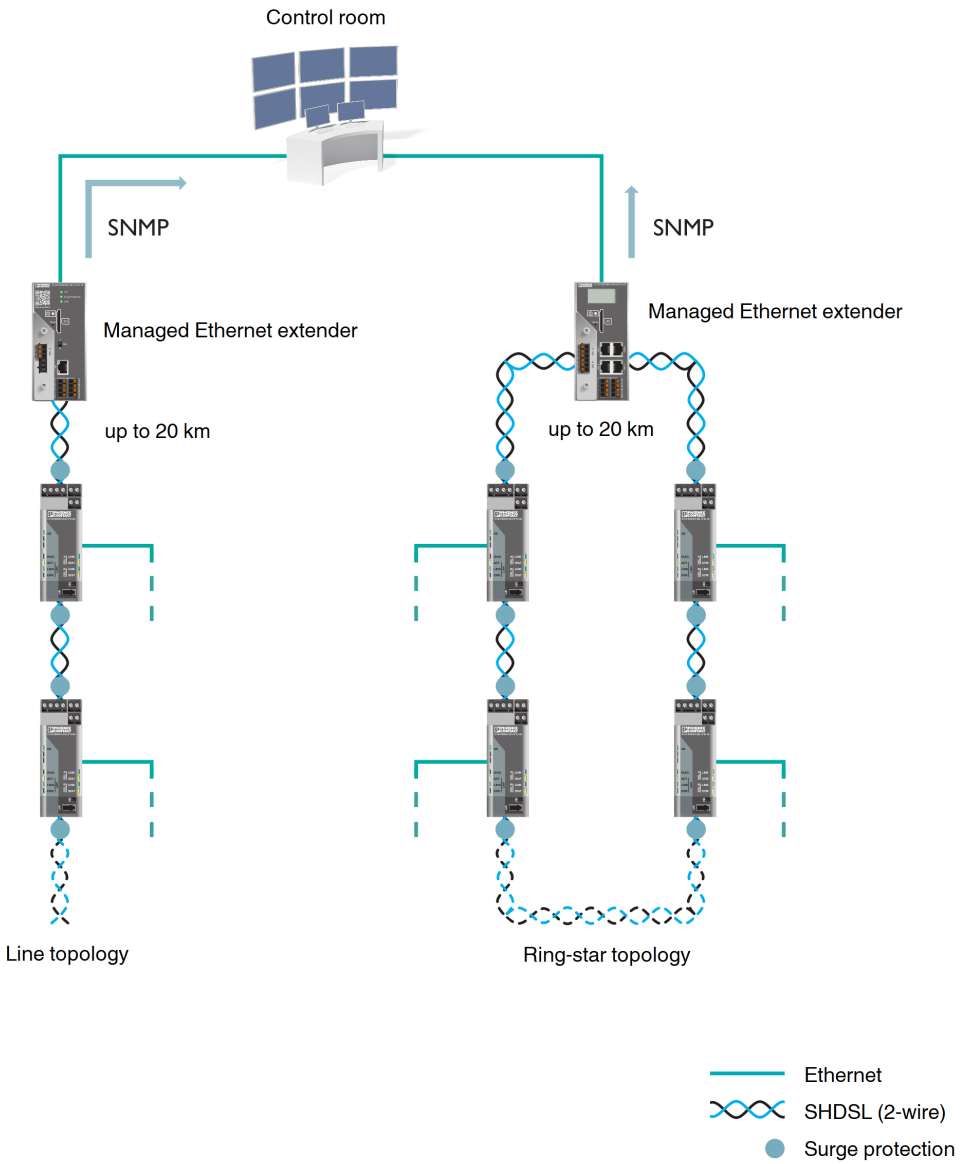
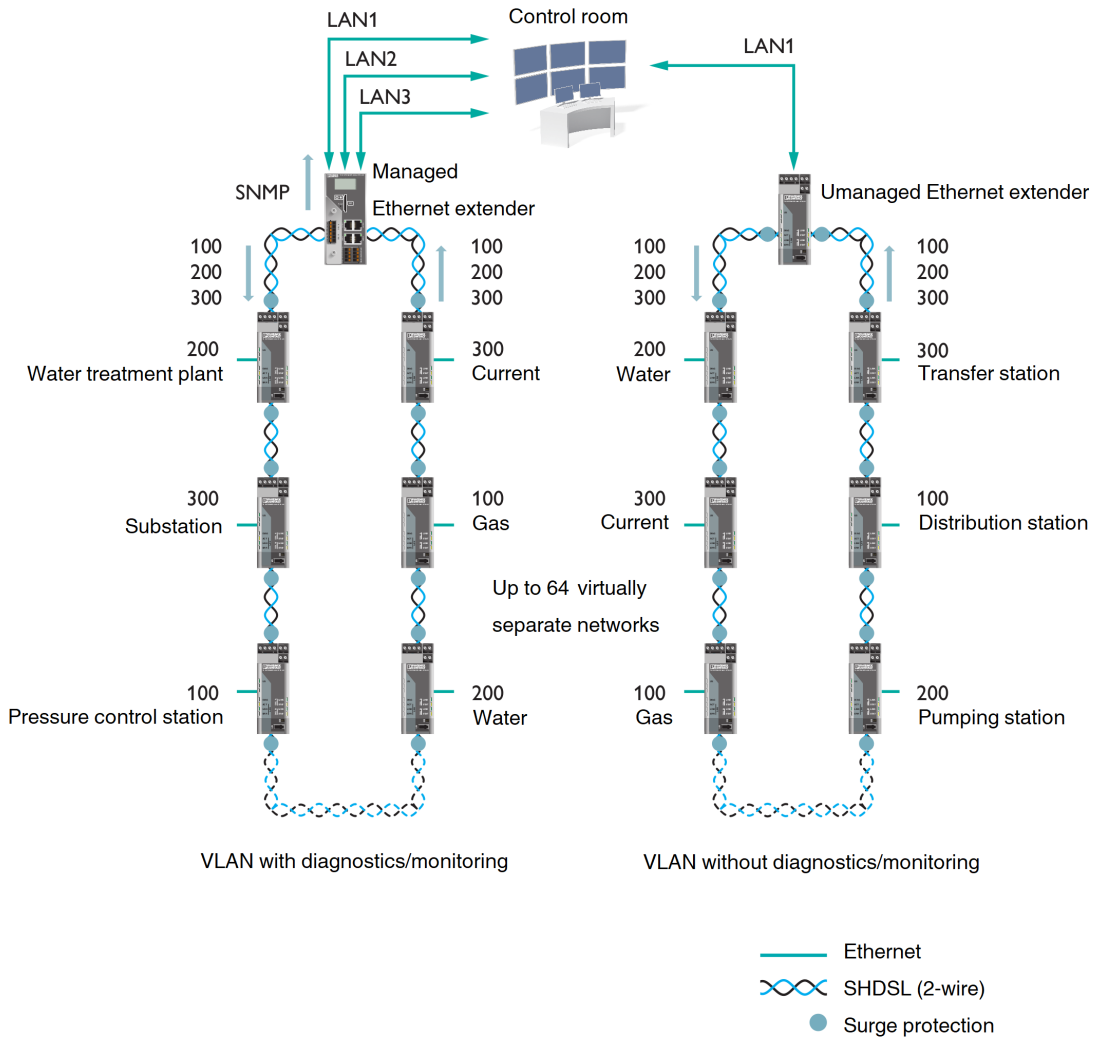


Figure 3-3 Using VLAN to virtually separate critical IP networks and make them secure



3.5 Open-source software

The notes below only apply to Managed Ethernet extenders.

3.5.1 Notes on LGPL software libraries

All open-source software used in the product is subject to the respective license terms that are not affected by the end user license agreement (EULA) for the product.

In particular, the license holder can change the respective open-source software in accordance with the applicable license terms. If the license holder wishes to change an LGPL software library contained in this product, reverse engineering is permitted for debugging such modifications.

3.5.2 Notes for OpenSSL

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (http://www.openssl.org/)

3.5.3 Requesting source code

The devices contain software components which are licensed by the rights holder as free software or open-source software under the GNU General Public License.

You can request the source code of these software components in the form of a CD or DVD-ROM for a processing fee of 50 euros within three years after delivery of the device.

Contact the After Sales Service of Phoenix Contact in writing about this at the address:

PHOENIX CONTACT GmbH & Co. KG
After Sales Service
Flachsmarktstrasse 8
32825 Blomberg
GERMANY

Subject:

Source Code TC EXTENDER...

3.6 DSL technology

In contrast to an analog permanent line modem, DSL (Digital Subscriber Line) uses a greater frequency range, which enables a data rate that is several times higher. The modulation process is applied to different carrying frequencies for DSL. Modulation is therefore significantly less sensitive to external sources of electromagnetic interference.

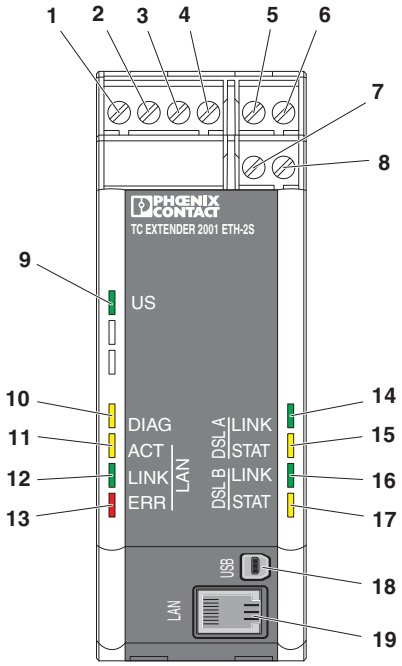
SHDSL is a version of this DSL technology. In contrast to other DSL technologies, a greater range can be realized with SHDSL. In addition, the bandwidth for upstream and downstream is equally large (symmetrical data transmission). For this reason, SHDSL is well suited to industrial applications.

Ethernet extenders with SHDSL technology are ideal for retrofitting a system, because the extenders can be used with the system's existing wiring.

SHDSL is standardized in the ITU-T G-991-2. Further technical information can be found there.

3.7 Function elements TC EXTENDER 2001 ETH-2S

Figure 3-4 Function elements TC EXTENDER 2001 ETH-2S



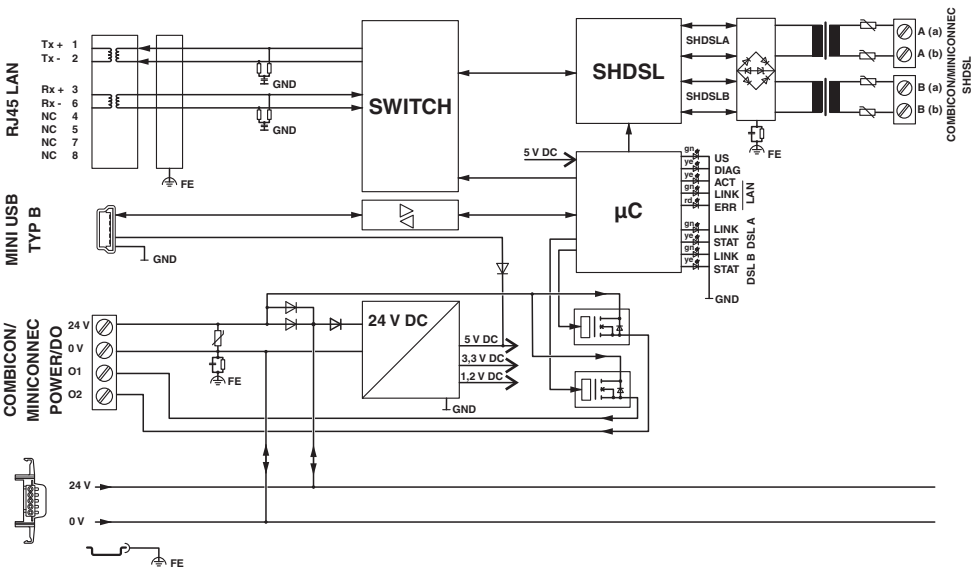
Plug-in screw terminal block	
1/2	Supply voltage
3/4	Digital switching outputs
5 ... 8	DSL connections port A (wire pair 1) / port B (wire pair 2)

Interfaces	
18	Mini-USB, type B (5-pos.): USB interface for configuration and diagnostics
19	RJ45, Ethernet interface (TP port)

Status and diagnostics indicators		
9	**US**	**Supply voltage**
	On	Supply voltage OK
	Flashing (1 Hz)	Supply via USB (only for configuration)
	Flashing (2 Hz)	Error during boot process (ERR also flashes)
10	**DIAG**	**Diagnostics**
	Off	No serious errors
	Flashing (1 Hz)	(Duration: 20 s after boot process) device is set to factory configuration
	Flashing (2 Hz)	Remote access from another extender (data transmission during remote configuration, remote diagnostics, firmware update)
	On	Serious error - reading of diagnostic data is recommended
11	**ACT**	**Ethernet interface**
	On	Data traffic
12	**LINK**	**Ethernet interface**
	On	Connection established
14/16	**LINK DSL A / B**	
	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
	Flashing (4 Hz)	ERR ON / STAT DSL OFF = Installation error: e. g., line structure configured, but 4-wire point-to-point connection implemented
	On	Connection established
15/17	**STAT DSL A / B**	
	Off	No connection established
	Off (pulsating)	Link quality adequate
	On (pulsating)	Link quality good
	On	Link quality very good

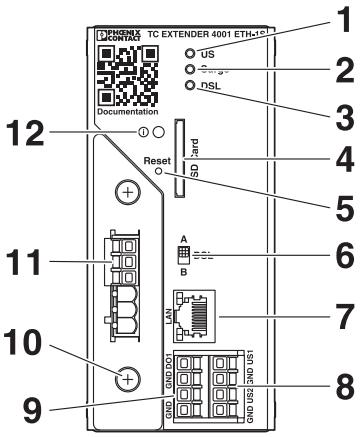
3.7.1 Block diagram

Figure 3-5 Block diagram TC EXTENDER 2001 ETH-2S



3.8 Function elements TC EXTENDER 4001 ETH-1S

Figure 3-6 Function elements TC EXTENDER 4001 ETH-1S



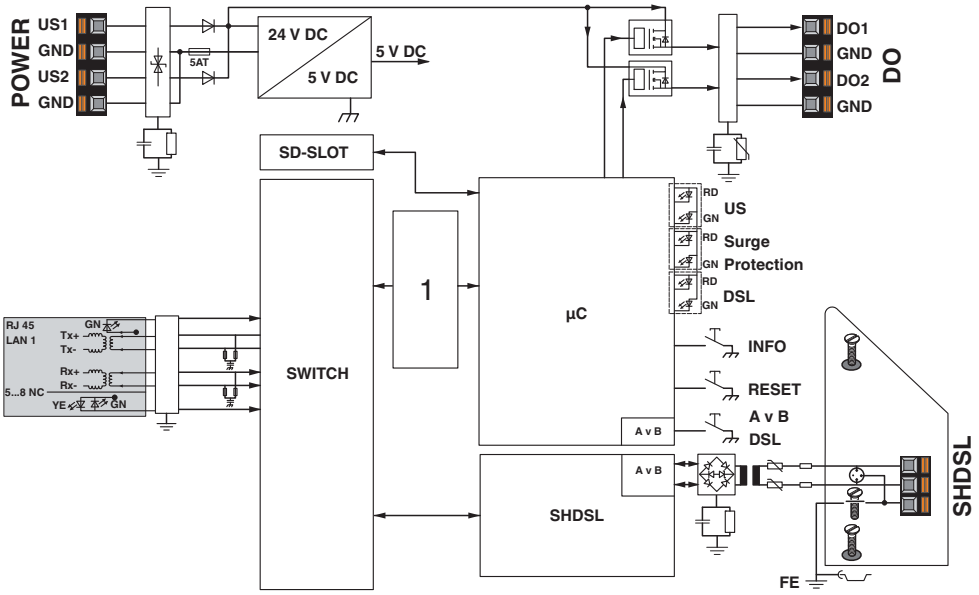
LED indicators		
1	**US**	**Supply voltage**
	Green	Device ready for operation
	Orange	Redundant supply voltage was present and has now failed.
2	**Surge Protection**	
	Green	Protection module OK
	Orange	DSL port is at performance limit, replacement of protection module recommended
	Red	DSL port overloaded, replace protection module
3	**DSL**	
	Green	Connection established, excellent signal
	Flashing green	Remote station found, initialization in progress
	Orange	Connection established, good signal
	Red	Connection established, bad signal Check the cable and the range.
	Flashing red	Configuration error, diagnostics via web-based management recommended

Connections		
8	**US1/US2**	Supply voltage, redundant
11	**SHDSL**	
	(a)/(b)	Client or server, depending on DSL switch
	S	Shielding
7	**Ethernet**	1 port, can be configured via web-based management
	LED, green	Connection established
	LED, yellow flashing	Data traffic
9	**DO1**	Alarm and signal output for DSL and LAN connections, can be configured via web-based management (see 3.8.1 “Block diagram”)

Operating elements	
4	Slot for SD card (see 6.4.4 “SD card (<2 GB)”)
5	Reset button (see 6.4.2 “Alternative access to the web-based management system, the 2-2-5 method”)
6	DSL switch for switching between DSL A (client) and DSL B (server)
10	Protection module (see 5 “Surge protection”)
12	Info button for function check of diagnostic LEDs

3.8.1 Block diagram

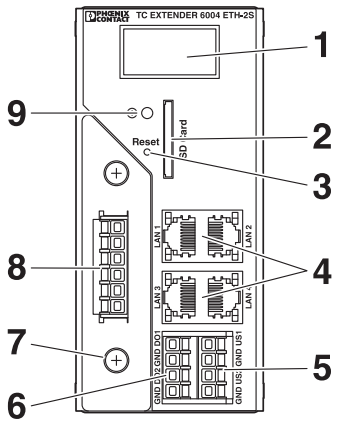
Figure 3-7 Block diagram TC EXTENDER 4001 ETH-1S



1 Transceiver

3.9 Function elements TC EXTENDER 6004 ETH-2S

Figure 3-8 Function elements TC EXTENDER 6004 ETH-2S

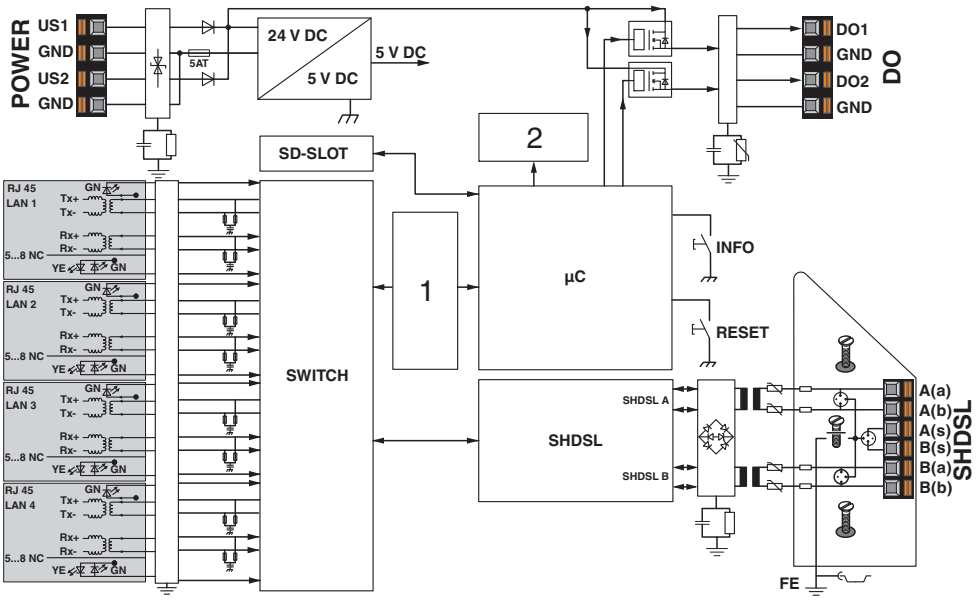


Connections		
5	**US1/US2**	Supply voltage, redundant
8	**SHDSL**	
	A(a)/A(b)	Port A, client
	A(s)/B(s)	Shielding, port A + B
	B(a)/B(b)	Port B, server
4	**Ethernet**	4-port switch, can be configured via web-based management
	LED, green	Connection established
	LED, yellow flashing	Data traffic
6	**DO1/DO2**	Alarm and signal outputs for DSL and LAN connections, can be configured via web-based management (see 3.9.1 “Block diagram”)

Operating elements	
1	Display for warning, status and device information
2	Slot for SD card (see 6.4.4 “SD card (<2 GB)”)
3	Reset button (see 6.4.2 “Alternative access to the web-based management system, the 2-2-5 method”)
7	Protection module (see 5 “Surge protection”)
9	Info button for operating the display, info pages 1 ... 8

3.9.1 Block diagram

Figure 3-9 Block diagram TC EXTENDER 6004 ETH-2S



1 Transceiver

2 Display

4 Installing

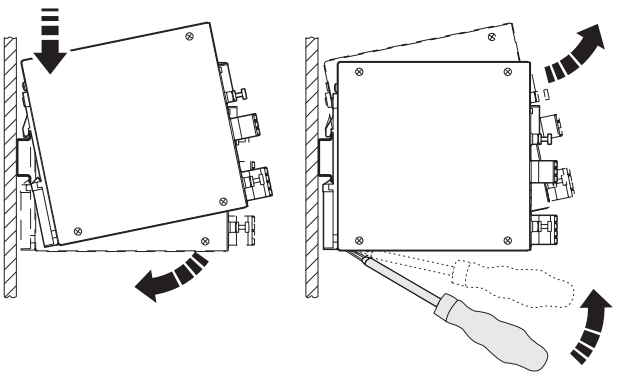
4.1 Mounting and dismounting

NOTE: device damage
Only mount and remove devices when the power supply is disconnected.

NOTE: Electrostatic discharge
Electrostatic discharge can damage or destroy components.
– When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) in accordance with EN 61340-5-1 and IEC 61340-5-1.

4.1.1 Mounting as a stand-alone device

Figure 4-1 Mounting as a stand-alone device



- Connect a 35 mm EN DIN rail to the protective earth via a grounding terminal block. The device is grounded by snapping it onto the DIN rail.
- Place the device onto the DIN rail from above.
- Push the device from the front toward the mounting surface until it audibly engages.

4.1.2 Mounting a joining station (TC EXTENDER 2001 ETH-2S only)

NOTE: device damage
High temperatures may damage the device.
- The maximum current load in a joining station must not exceed 2 A.
- A joining station must not consist of more than ten devices.
- Observe the permissible ambient temperature range.

Table 4-1 Ambient temperature TC EXTENDER 2001 ETH-2S

Operating mode and mounting		Ambient temperature
Operation	Freestanding, 40 mm spacing to the right and left, no supply of other modules via the device	-20°C ... 60°C
	Mounted in rows with zero spacing and low power dissipation of aligned modules	-20°C ... 55°C
	Mounted in rows with zero spacing	-20°C ... 50°C
	Mounted in rows with zero spacing and supply of other modules via the device, 1.5 A	-20°C ... 45°C
Storage/transport		-40°C ... 85°C

Figure 4-2 Restrictions for combined assembly

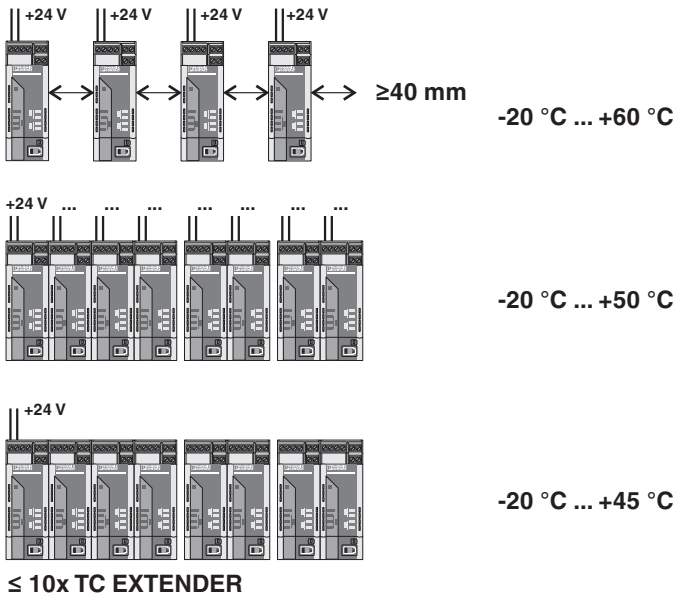
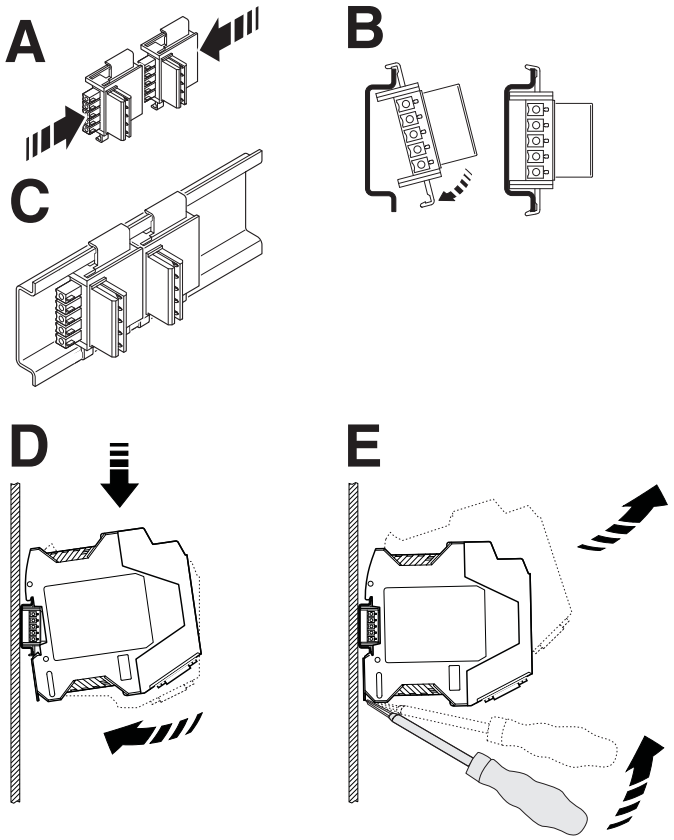


Figure 4-3 Mounting a joining station



Only connect the following devices together via the DIN rail connector:

– TC EXTENDER 2001 ETH-2S
– QUINT4-SYS-PS/1AC/24DC/2.5/SC, Item No. 2904614, see page 40

The pin assignment may differ for other devices.

- For one joining station, plug the DIN rail connectors together (Item No. 2709561, 2 per device).
- Push the connected DIN rail connectors into the DIN rail.
- Place the device onto the DIN rail from above. Ensure the device and DIN rail connector are aligned correctly.
- Push the front of the device toward the mounting surface until it audibly snaps into place.

4.1.3 Dismounting

NOTE: device damage
Only remove devices when the power supply is disconnected.

- Disconnect all cables from the device.
- Push down the locking latch using a screwdriver, needle-nose pliers or similar.
- Pull the device away from the DIN rail.
- When you dismantle a joining station, also remove the DIN rail connectors.

4.2 Connecting DSL

NOTE: Malfunction
Do **not** connect DSL port A to DSL port B of the **same** device. If you do, this will create a DSL loop.

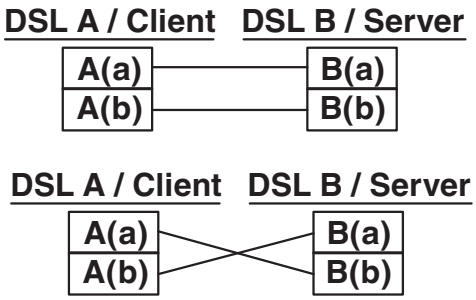
The devices connect automatically. The devices only have to be configured if diagnostics via IP address is required.

We recommend the following cable types:
– Coaxial cables (optimal)
– Twisted pair cables (good)
– Star-quad and non-twisted cables (OK)

Table 4-2 Possible DSL data rates

Operation	Settings	Data rate
2-wire	Automatic data rate detection, default setting	192 kbps ... 5696 kbps
	Manually	32 kbps ... 15.32 Mbps
4-wire	Automatic data rate detection, default setting	384 kbps ... 11392 kbps
	Manually	≤30 Mbps

Figure 4-4 Possible DSL connections



4.2.1 2-wire

- Connect DSL port A at device 1 (client) to DSL port B at device 2 (server).
- SHDSL is an alternating voltage signal. The polarity of the connections is therefore not important: (a)-(a) / (b)-(b) or (a)-(b) / (b)-(a).

Establishing the DSL connection automatically can take up to one minute.

4.2.2 4-wire

Only possible with TC EXTENDER 2001 ETH-2S and TC EXTENDER 6004 ETH-2S

- To avoid crosstalk, use two separate cables where possible.
- Otherwise, observe the notes in the sections 4.2.4 “Twisted pair cables” or 4.2.5 “Star-quad and non-twisted cables”.
- Connect two devices crosswise:
  - DSL port A (device 1) - DSL port B (device 2)
  - DSL port B (device 1) - DSL port A (device 2)

Automatic 4-wire detection needs up to two minutes for establishing the connection.

- If you set the data rate manually, where possible assign the same data rate to the separate cables.

4.2.3 Topologies

The topologies illustrated use TC EXTENDER 2001 ETH-2S by way of example.

Figure 4-5 2-wire operation, line structure or point-to-point connection

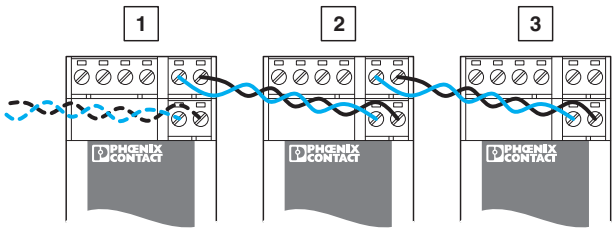


Figure 4-6 2-wire operation, ring structure

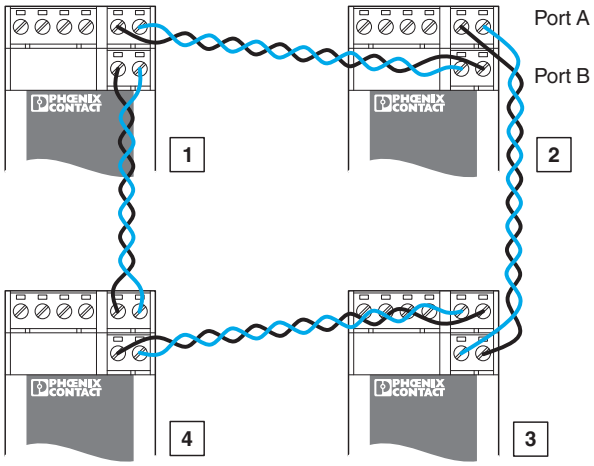
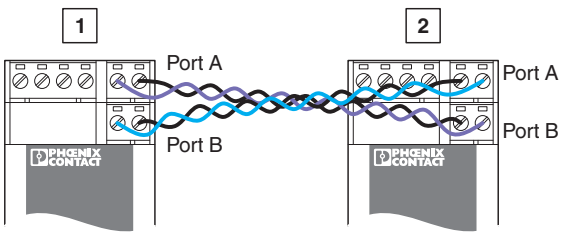
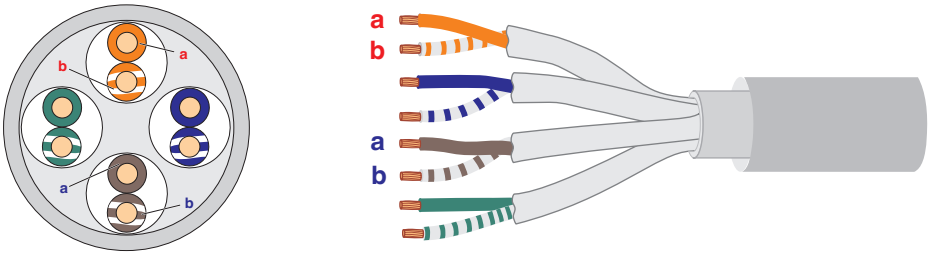


Figure 4-7 4-wire operation, point-to-point connection



4.2.4 Twisted pair cables

Figure 4-8 Twisted pair cables



2-wire

- Use the opposing single-core wires of a related double wire, e.g. a - b.
- Observe the cable specification or the standardized cable coding.

4-wire

We recommend using two separate cables. Transmission with one cable is possible in exceptional circumstances. However, data rates may be reduced due to crosstalk.

- If only using one cable, you must always use opposing single-core wires and double wires (a - b and a - b).

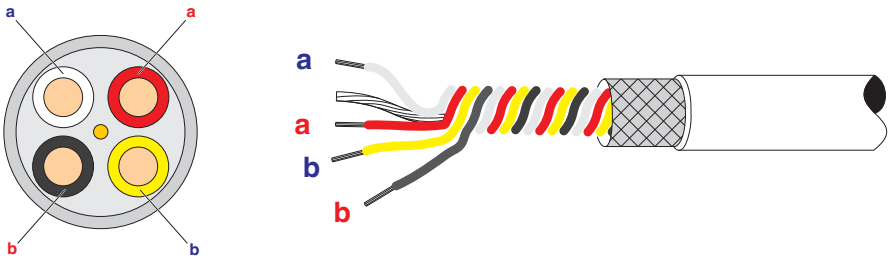
4.2.5 Star-quad and non-twisted cables

We recommend coaxial cables or twisted pair cables.

Only use cables with star-quad stranding and non-twisted cables if there is no other option. The connection can be susceptible to interference.

4.2.5.1 2-pair cable

Figure 4-9 2-pair cable with 2 double wires



2-wire

- Use opposing single-core wires, e.g. a - b.

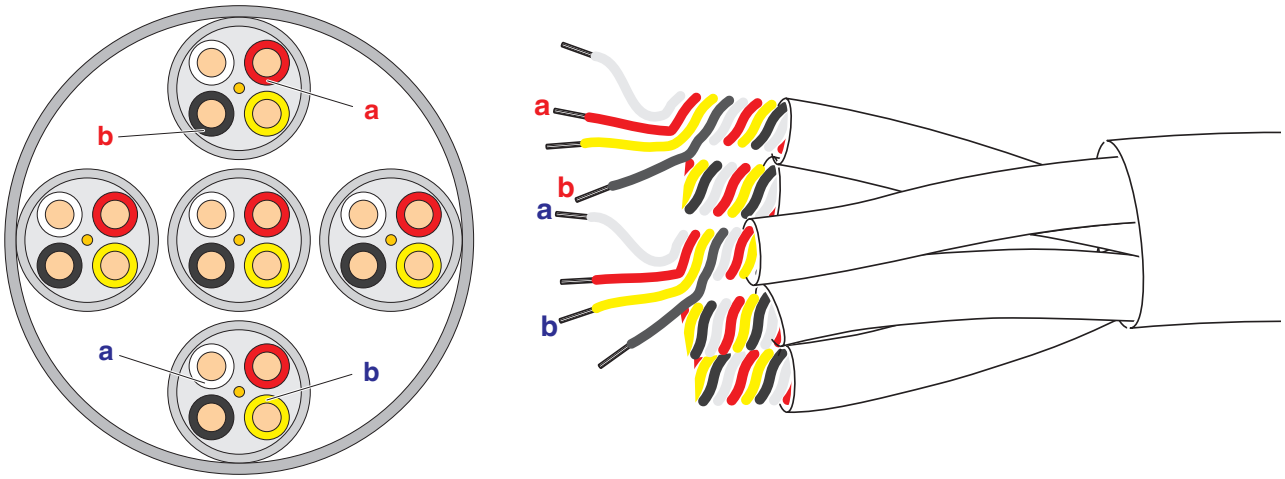
4-wire

Crosstalk makes 4-wire transmission with a 2-pair cable virtually impossible.

- Use two separate cables.

4.2.5.2 10-pair cable

Figure 4-10 10-pair cable



2-wire

- Use the opposing single-core wires of a related double wire, e.g. a - b.
- Observe the cable specification or the standardized cable coding.

4-wire

We recommend using two separate cables. Transmission with one cable is possible in exceptional circumstances. However, data rates may be reduced due to crosstalk.

- If only using one cable, you must always use opposing single-core wires and double wires (a - b and a - b).

4.2.5.3 Color codes for various cable types

Figure 4-11 Phone cable with bundle stranding

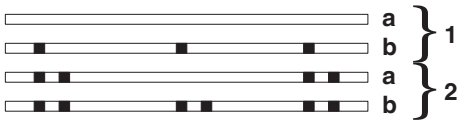
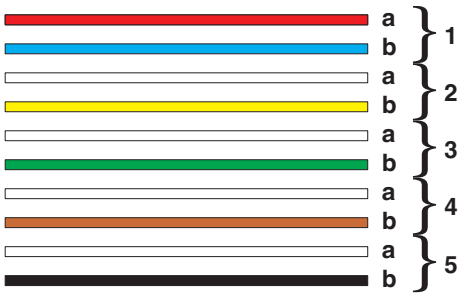


Figure 4-12 Layer stranding, two double wires, e.g. J-Y(ST)Y 2 x 2 x 0,6

Figure 4-13 Layer stranding, five double wires, e.g. J-Y(ST)Y 5 x 2 x 0,6



4.3 Connecting Unmanaged Ethernet extenders

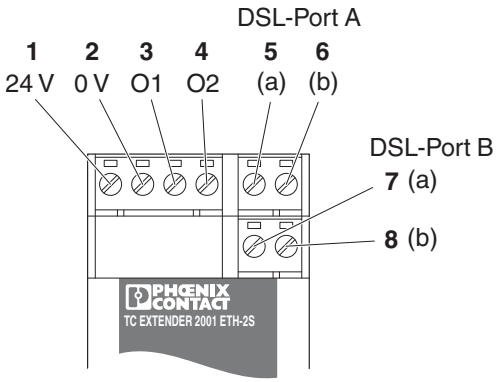
4.3.1 Supply voltage

NOTE: malfunction
When using the switching outputs, you must supply the device with power via the COMBICON screw terminal block. In this case, it is **not** possible to feed in the power supply via the DIN rail connector.

Railway applications according to EN 50121-4 outside the 3 m range:
Use QUINT POWER power supply units from Phoenix Contact directly on the device. Supply the voltage to the module via terminal blocks **1** (24 V) and **2** (0 V).

4.3.1.1 COMBICON screw terminal block

Figure 4-14 Connections TC EXTENDER 2001 ETH-2S



- Supply voltage to the device via terminal blocks **1** (24 V) and **2** (0 V).

4.3.1.2 DIN rail connector

As an alternative, the supply voltage can be provided via the DIN rail connectors with a system power supply. When mounting the device on the DIN rail connector, please observe section 4.1.2.

NOTE: device damage
The maximum current load in a joining station must not exceed 2 A.

- Connect the system power supply with one DIN rail connector to the left of the joining station.
  - QUINT4-SYS-PS/1AC/24DC/2.5/SC, Item No. 2904614
  - DIN rail connector, Item No. 2713645

4.3.1.3 USB interface

When using the supply via USB, you can configure the device without an external power supply. DSL operation is **not** possible when power is supplied via USB.

LED US

Table 4-3 LED US

LED	Description
On	Supply voltage OK
Flashing (1 Hz)	Supply via USB (only for configuration)
Flashing (2 Hz)	Error during boot process (ERR also flashes)

4.3.2 Digital switching outputs

NOTE: Malfunction
Provide the digital switching outputs with a load between 220 Ω and 100 kΩ.

The switching voltage that is actually output depends on the connected supply voltage (18 V DC ... 30 V DC). The maximum output signal is 150 mA (short-circuit-proof).

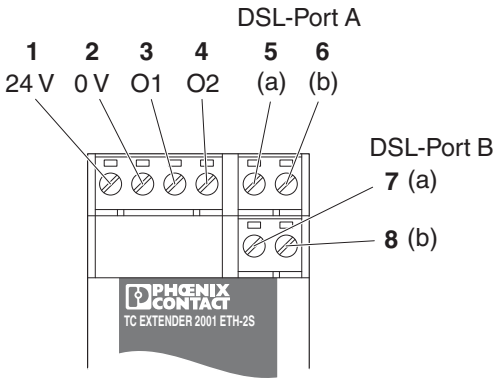
You can use the switching outputs to display and evaluate events at the DSL ports and the Ethernet interface.

- Configure the switching outputs via the PSI-CONF software (see section 6.3).

Table 4-4 Behavior of the switching outputs, TC EXTENDER 2001 ETH-2S

Default setting, 24 V supply voltage			
DSL port	**Output**	**Status**	**Connection**
A	O1	24 V	Good to very good connection
		Open	No or only moderately good connection
B	O2	24 V	Good to very good connection
		Open	No or only moderately good connection

Figure 4-15 Two digital switching outputs, TC EXTENDER 2001 ETH-2S



4.3.3 Ethernet interface

NOTE: malfunction
Only use shielded twisted pair cables with an impedance of 100 Ω, e. g. patch cable FL CAT5 PATCH 0,5 (Item No. 2832263).

If the RJ45 connector is not properly latched in, communication errors occur. These are very difficult to locate afterwards.

- When connecting, ensure that the RJ45 connector is latched properly.

4.3.4 USB interface

WARNING: Explosion hazard when used in potentially explosive areas!
Only use the interface if it has been ensured that there is no potentially explosive atmosphere present.

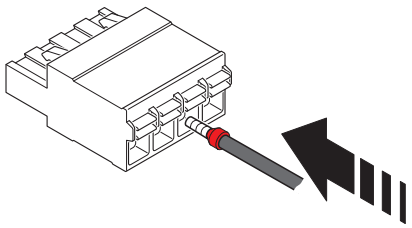
Via the USB interface, you can configure all Ethernet extenders or read out the diagnostic information. To connect the Ethernet extender to a computer, use the cable CABLE-USB/MINI-USB-3.0M (Item No. 2986135).

When using the supply via USB, you can configure the device without an external power supply. DSL operation is **not** possible when power is supplied via USB.

4.4 Connecting Managed Ethernet extenders

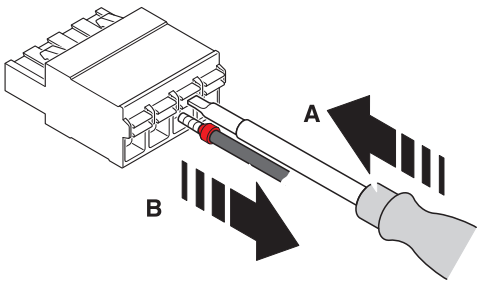
4.4.1 Push-in connection

Figure 4-16 Install signal cable



- Rigid conductors / ferrule assembled conductors: Insert the conductors directly into the terminal block without using a tool.
- Flexible conductors: Open the terminal block first. To do so, insert a screwdriver into the release slot above the connection terminal block.

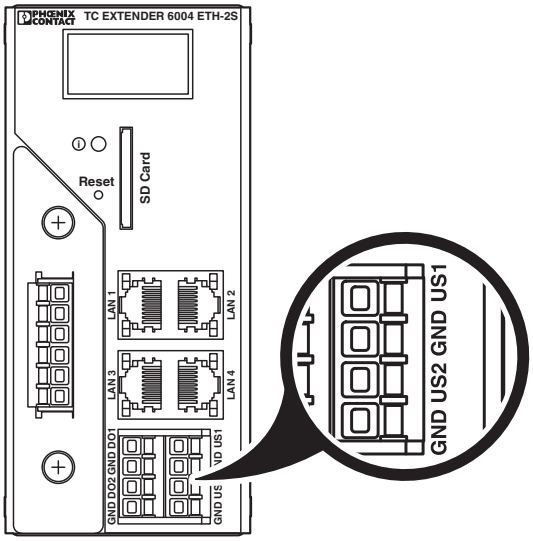
Figure 4-17 Deinstall signal cable



- Insert a screwdriver into the release slot above the connection terminal block (A).
- Remove the conductor from the terminal block (B).

4.4.2 Supply voltage

Figure 4-18 Connecting the supply voltage TC EXTENDER 4001 ETH-1S and TC EXTENDER 6004 ETH-2S



- Connect the supply voltage to the push-in terminal block.

US1	24 V DC	Supply voltage
GND	0 V DC	
US2	24 V DC	Supply voltage, redundant
GND	0 V DC	

4.4.3 Digital switching outputs

Provide the digital switching outputs with a load between 200 Ω and 100 kΩ.

The switching voltage that is actually output depends on the connected supply voltage (10 V DC ... 60 V DC). The maximum output signal is 500 mA (short-circuit-proof).

You can use the switching outputs to display and evaluate events at the DSL ports and the Ethernet interface.

- Configure the switching outputs via web-based management (see section 6.4).

Table 4-5 Behavior of the switching outputs, Managed Ethernet extender

Default setting, 24 V supply voltage			
DSL port	**Output**	**Status**	**Connection**
A	O1	24 V	Good to very good connection
		Open	No or only moderately good connection
B	O2	24 V	Good to very good connection
		Open	No or only moderately good connection

Figure 4-19 One digital switching output, TC EXTENDER 4001 ETH-1S

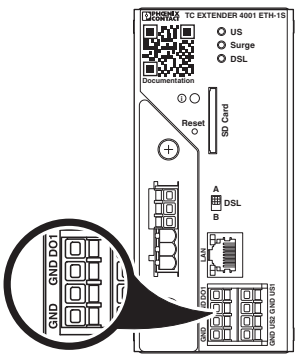
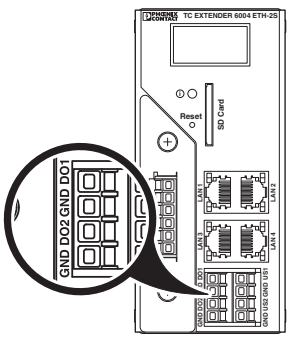


Figure 4-20 Two digital switching outputs, TC EXTENDER 6004 ETH-2S



4.4.4 Ethernet interface

NOTE: malfunction
Only use shielded twisted pair cables with an impedance of 100 Ω, e. g. patch cable FL CAT5 PATCH 0,5 (Item No. 2832263).

If the RJ45 connector is not properly latched in, communication errors occur. These are very difficult to locate afterwards.

- When connecting, ensure that the RJ45 connector is latched properly.

5 Surge protection

In the event of a storm, high-energy transients can occur. Without protection, they are coupled into the 2-wire line. Products are available that are tailored to your specific protection application.

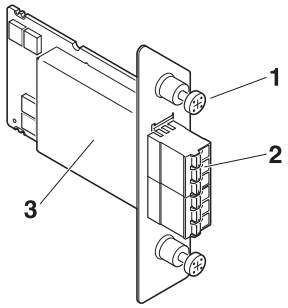
The Managed Ethernet extenders feature integrated, replaceable surge protection for the SHDSL cable.

Table 5-1 Accessories: Surge protection

Line	TC EXTENDER...	Surge protection	Item No., link	Integrated into the device?
Ethernet	...2001 ETH-2S	DT-LAN-CAT.6+	2881007	No
	...4001 ETH-1S			
	...6004 ETH-2S			
SHDSL	...2001 ETH-2S	DT-TELE-SHDSL	2801593	No
	...4001 ETH-1S	TC EXTENDER PT-IQ -1S	2702257	Yes
	...6004 ETH-2S	TC EXTENDER PT-IQ -2S	2702258	

5.1 Managed Ethernet extenders with integrated surge protection

Figure 5-1 Protection module



1 Mounting screw
2 Plug-in spring-cage terminal block
3 Surge protection

5.1.1 Status display

TC EXTENDER 4001 ETH-1S

LED Surge Protection on the device	
Green	Protection module OK
Orange	DSL port is at performance limit, replacement of protection module recommended
Red	DSL port is overloaded, replace protection module

TC EXTENDER 6004 ETH-2S

Info page 4 on the display	
3 bars	Protection module OK
2 bars	Several overvoltage events at one of the two DSL ports, protection module still fully functional
1 bar	At least one of both DSL ports is at performance limit, replacement of protection module recommended
No bars	At least one of the DSL ports is overloaded, replace protection module

5.1.2 Equipotential bonding

Equipotential bonding must be designed according to the latest technology. Short conductor lengths optimize the protection level.

- Connect the DIN rail to the protective earth ground.
- Connect the ground connection (screw) via the shortest possible route to the local equipotential bonding using a suitable cable.
- Ensure that the Ethernet extender is correctly snapped onto the DIN rail.
- After replacing a protection module: Torque both screws to 0.4 Nm.

5.1.3 Replacement of protection module

NOTE: device damage
Only mount and remove devices when the power supply is disconnected.

NOTE: Electrostatic discharge
Electrostatic discharge can damage or destroy components.
When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) in accordance with EN 61340-5-1 and IEC 61340-5-1.

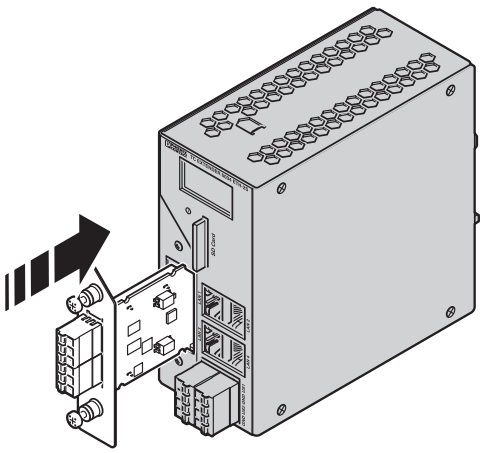
Dismounting

- Remove the plug-in spring-cage terminal block at the DSL port of the Ethernet extender.
- Loosen the two screws of the protection module with a screwdriver.
- Use both hands to carefully pull the faulty protection module out of the Ethernet extender.

Mounting

- Use both hands to carefully insert the new protection module into the guide rail of the Ethernet extender.
- Torque both screws to 0.4 Nm.
- Execute the equipotential bonding correctly (refer to “Equipotential bonding”).

Figure 5-2 Replacement of protection module



6 Configuration

6.1 Immediate commissioning and factory settings

In the factory settings, all Ethernet extenders support automatic DSL transmission detection for data rate and topology. This enables the Plug and Play installation of up to 50 Ethernet extenders per segment unit.

If the following factory settings are sufficient for your application, configuration via the PSI-CONF software or the web-based management is **not** necessary. You can commission the Ethernet extenders immediately.

Table 6-1 Factory settings

TC EXTENDER...	...2001 ETH-2S	...4001 ETH-1S	...6004 ETH-2S
DSL transmission detection	Automatic		
Ethernet detection	Autoneg		
DSL transmission speed	192 kbps ... 5.696 Mbps, depending on range, quality of cables, and interference distance		
DSL transmission speed can be set manually	Via PSI-CONF software up to 15.3 Mbps	Via web-based management up to 15.3 Mbps	
Ethernet transmission speed	10 or 100 Mbps		
Ethernet port status	Port active	Port active	All 4 ports active
Alarm and signal outputs	18 V ... 30 V DC, when the DSL connection is good or excellent	10 ... 60 V DC, when the DSL connection is good or excellent	
Alarm and signal outputs status	DSL A = O1, DSL B = O2	DSL A/B = O1	DSL A = O1, DSL B = O2
IP address and subnet mask	-	Alternating BootP/DHCP client	
Web-based management	No Configuration via PSI-CONF software	Yes – User account: No write access, read-only access for “Information” and “Diagnostics” – Admin account: Full read and write access, user management	
Resetting to factory settings	See Section “Unmanaged extenders” on page 51	See Section “Managed extenders” on page 51	

6.1.1 Resetting to factory settings

6.1.1.1 Unmanaged extenders

This function is only available via the PSI-CONF software in online local.

WARNING: Explosion hazard when used in potentially explosive areas!
Do **not** install the USB cable in potentially explosive areas. It is only suitable for use in the safe area.

- To connect the Ethernet extender USB interface to a computer, use the cable CABLE-USB/MINIUSB-3,0M (Item No. 2986135).
- Open the PSI-CONF software on your computer.
- If necessary, save the active configuration on the computer.
  Resetting to the factory settings will overwrite all customized settings. The factory settings are listed in Table 6-1.
- In the menu, go to “Online local, Configuration, Reset to factory settings”.

6.1.1.2 Managed extenders

WARNING: Explosion hazard when used in potentially explosive areas!
In potentially explosive areas, only connect and disconnect cables when the power is disconnected.
Replacing the SD card is only permitted when the power is disconnected.

- If necessary, save the active configuration on the computer or on an SD card.
  Resetting to the factory settings will overwrite all customized settings.
- Disconnect the device from the supply voltage.
- If an SD card is still inserted in the device, remove it.
- Press and hold down the Reset button.
- Connect the supply voltage.
- Wait approximately 7 seconds. For devices with a display, “Load factory settings ... OK” appears on the display.
- Release the reset button.

Access to the web-based management and the access rights are now reset to the delivery state:

– IP address and subnet mask: Alternating BootP/DHCP client
– User access
  User name: user, password: user
– Administrator access
  User name: admin, password: admin
– For further information, see Table 6-1

6.2 Mixed operation of Managed and Unmanaged Ethernet extenders

When you operate Managed and Unmanaged Ethernet extenders in one system, you can configure all the devices and carry out diagnostics operations via Ethernet and the web-based management (see 6.4 “System operation of Managed Ethernet extenders”).

Configuration via the PSI-CONF software is **not** possible.

6.3 System operation of Unmanaged Ethernet extenders

When you only operate Unmanaged Ethernet extenders in one system, you can configure the devices and carry out diagnostics operations via the PSI-CONF software.

Prerequisites

– The segment or segment unit only contains Unmanaged Ethernet extenders
– Operating system: Qualified with Windows® 10

6.3.1 Installing the software

You can download the PSI-CONF software free of charge at phoenixcontact.net/product/2702409.

During installation of the PSI-CONF software, a USB driver and Microsoft NET Framework 2.0 will be installed on your computer. If they are not installed correctly, you will not be able to access the Ethernet extender.

- In this case, update the installation files
- Repeat the installation process.

6.3.2 Connecting the computer via USB

WARNING: Explosion hazard when used in potentially explosive areas!
Do **not** install the USB cable in potentially explosive areas. It is only suitable for use in the safe area.

- To connect the Ethernet extender USB interface to a computer, use the cable CABLE-USB/MINIUSB-3,0M (Item No. 2986135).
- When using the supply via USB, you can configure the device without an external power supply. DSL operation is **not** possible when power is supplied via USB.
- You can set the following manually via the software:
  – Very low data rates (<192 Kbps)
  – Very high data rates (>5.696 Mbps)
  – Configuration of the switching outputs

6.3.3 Configuration via PSI-CONF software

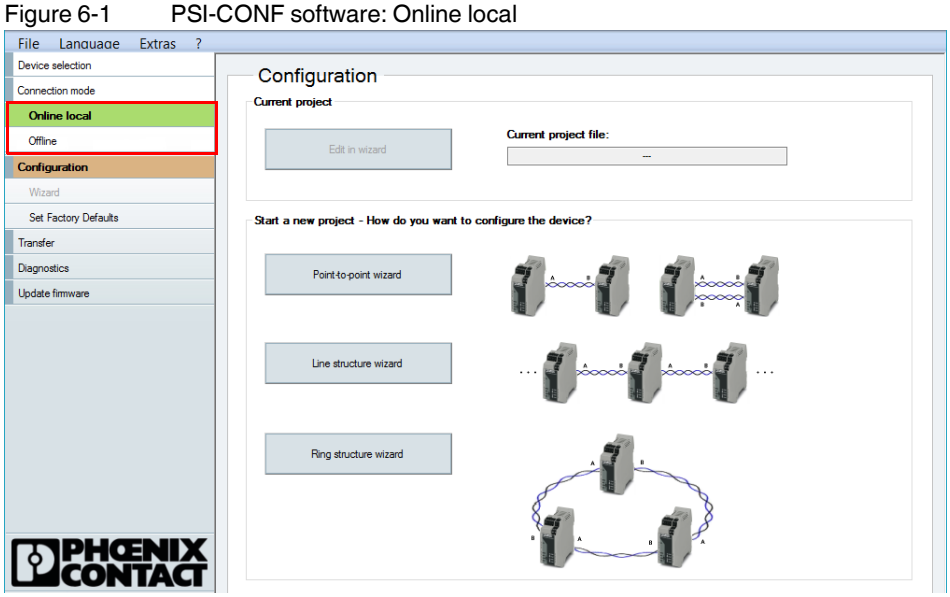
- Start the PSI-CONF software. Select the device.

The software always starts in offline mode.

– **Offline:** The configuration is saved as a project file on the computer. You can later load the configuration to the device. Ensure that the correct topology and number of devices are specified in the configuration file.

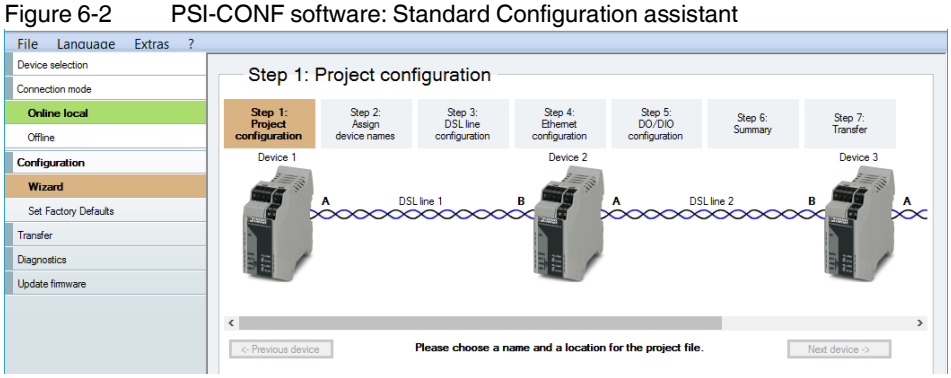
– **Online local:** The configuration is saved directly to the device.

Figure 6-1 PSI-CONF software: Online local



The assistant guides you through the configuration process in several steps.

Figure 6-2 PSI-CONF software: Standard Configuration assistant



6.3.4 Diagnostics

The PSI-CONF software features the following diagnostic functions:

- Status of all devices available in the system
- Status of all lines available in the system
- Logbook for system events, such as:
  - Device failures
  - Line failures
  - Topology changes
  - Changes in the connection quality
- Values logbook, containing for example:
  - SHDSL line attenuation
  - Signal-to-noise ratio
  - SHDSL data rate
  - Connection interruptions

6.3.5 Saving and loading configurations

Functions:

- Read off system configuration and save to a file
- Open an existing system configuration and write it to the devices

6.3.6 Firmware update

You will find the latest firmware version at phoenixcontact.net/product/2702409.

Functions:

- Display the current device firmware
- Update the locally connected device
- Update all devices via SHDSL

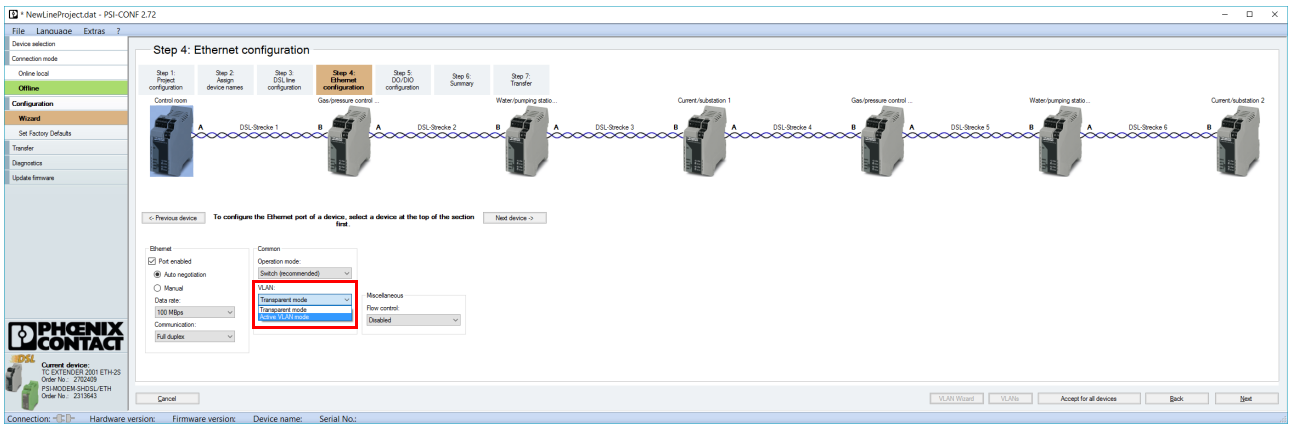
6.3.7 Configuring VLAN

The VLAN configuration is shown here using Unmanaged extenders with the PSI-CONF software as an example. You can configure a system with Managed extenders in the same way via the web-based management.

First configure the device with the standard Configuration assistant.

- Assign unique device names; see 6.4.3.6 “Standard Configuration assistant”.
- Then restart the standard Configuration assistant.
- Proceed to “Step 4: Ethernet configuration”.
- PSI-CONF software: Select “Active VLAN mode”.
  Web-based management: Go to the menu item VLAN; see “VLAN”.
- Select “VLAN Assistant”.

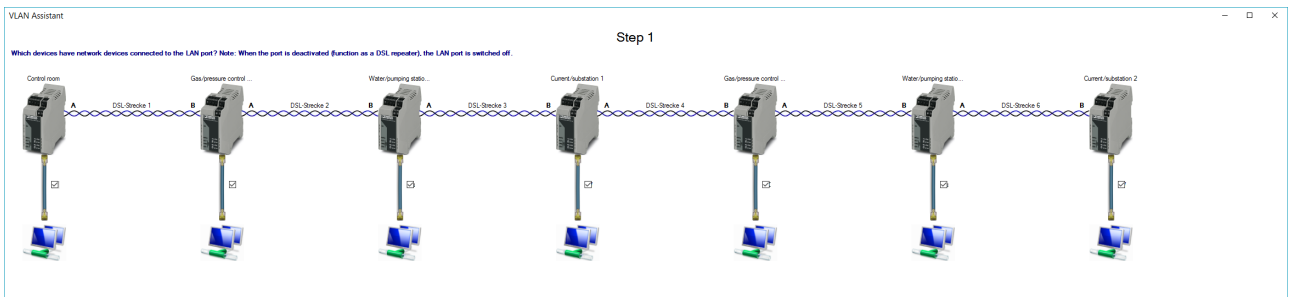
Figure 6-3 PSI-CONF software: Ethernet configuration



VLAN Assistant

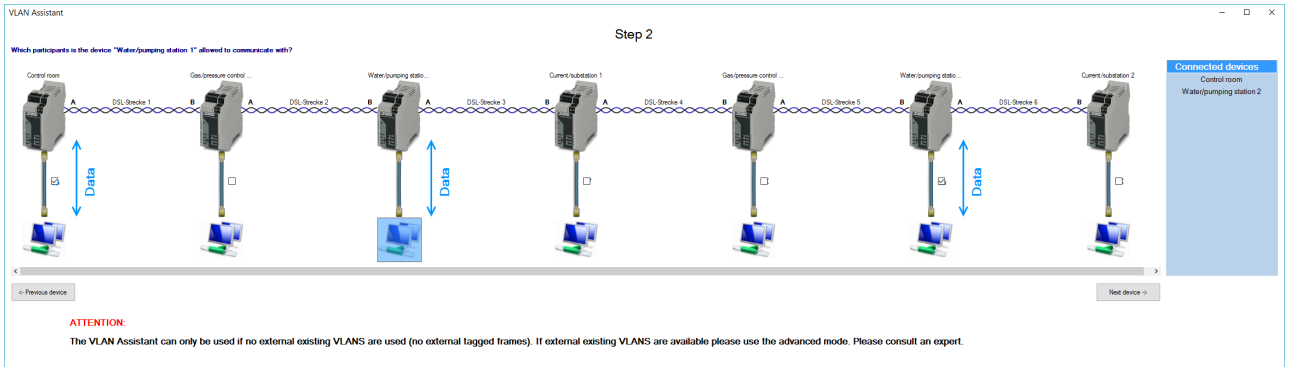
- Select the devices that have a network device connected to their LAN port.
- If you deactivate a check box, the corresponding LAN port is switched off. The Ethernet extender then takes on the function of a repeater.

Figure 6-4 VLAN Assistant: Activating and deactivating LAN ports



- Select which device the selected device may communicate with. To do so, click on the PC symbol below an Ethernet extender.
- To allow communication with the device, activate the respective check box.

Figure 6-5 VLAN Assistant: Selecting devices



- Check and confirm your configuration.

You have now returned to step 4 of the standard Configuration assistant.

- Follow the assistant up to “Step 7: Transfer”.
- Transfer the settings to all connected devices using the automatic transfer function. Ensure that the connection to the devices is not interrupted during the transfer.
- You will find an overview of the VLAN configuration in step 6 under “VLAN”. If necessary, print it off.

6.3.7.1 Expert mode

To make special VLAN configuration settings, you can also use the expert mode.

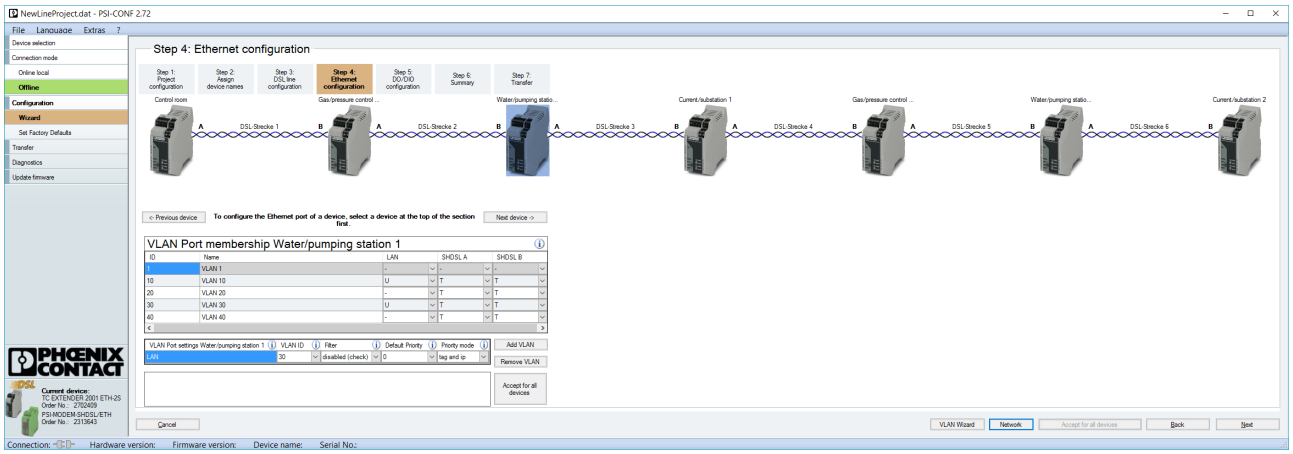
First configure the device with the standard Configuration assistant.

- Assign unique device names.
- Then restart the standard Configuration assistant.
- Proceed to “Step 4: Ethernet configuration”.
- PSI-CONF software: Select “Active VLAN mode”.
  Web-based management: Go to the menu item VLAN; see “VLAN”.
- Select “VLANs”.

A configuration window opens.

- Select the devices in the topology. Enter the VLAN parameters for the respective device.
- Hovering over elements with the mouse will provide you with further information on the functions and settings.

Figure 6-6 Configuring VLAN in expert mode



- Check the configuration.
- To return to the standard Configuration assistant, click on “Network”.

You have now returned to step 4 of the standard Configuration assistant.

- Follow the assistant up to “Step 7: Transfer”.
- Transfer the settings to all connected devices using the automatic transfer function. Ensure that the connection to the devices is not interrupted during the transfer.
- You will find an overview of the VLAN configuration in step 6 under “VLAN”. If necessary, print it off.

6.4 System operation of Managed Ethernet extenders

In the following cases, you can configure all devices and carry out diagnostics operations via Ethernet and the web-based management:

– System operation of Managed Ethernet extenders
– Mixed operation of Unmanaged and Managed extenders

Using the web-based management, you can:

– Configure the DSL interface
– Configure Ethernet interfaces
– Configure alarm and signal outputs
– Perform diagnostics on all lines and DSL devices via IP

System requirements

– Operating system: Qualified with Windows® 10
– Web browser: Qualified with Chrome 83.0 / 64-bit

WARNING: Explosion hazard when used in potentially explosive areas!
In potentially explosive areas, only connect and disconnect cables when the power is disconnected.

- Connect a PC to the LAN connection of the device.
- Enter the IP address of the device in your web browser.
- If you cannot access the device via the web browser, check the following:
  – Have you entered the IP address of the connected device correctly?
  – Is the network card of your computer in the same IP range as the extender?
  – Is a virus scanner on your computer blocking communication?
  – Is the web browser expecting communication with a proxy server?

6.4.1 Setting the IP address

The Ethernet interface is in alternating mode in the factory setting. The interface switches between BootP and DHCP continuously. The alternating mode is stopped when, for example, you assign and save a fixed IP address.

There are three methods of setting the IP address:

DHCP client (factory setting)

If you operate a DHCP server in the Ethernet network, an IP address is assigned to the Ethernet extender. You will find the address on the DHCP server.

With TC EXTENDER 6004 ETH-2S, you will also find the address on the device display, info page 5.

BootP (factory setting)

The device sends BootP requests continuously until it receives a valid IP address.
You can download a tool for BootP addressing free of charge at phoenixcontact.net/product/2702253.

- Start the tool.
- A list of all devices that are sending a BootP request is displayed. Select the MAC address of your device. You will find the MAC address on the side of the device.
- Assign an IP address.

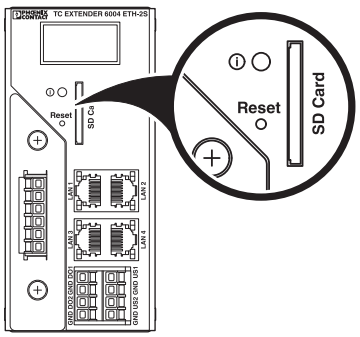
Static

To receive access to the web server with the specified IP address, you must match the computer's IP address and subnet mask to the Ethernet extender.

- If you do not want to use either DHCP or BootP, you will have to set the IP address manually (see "Alternative access to the web-based management system, the 2-2-5 method").

6.4.2 Alternative access to the web-based management, the 2-2-5 method

Figure 6-7 Reset button



TC EXTENDER 4001 ETH-1S

- Connect a PC to the LAN connection of the device.
- Press and hold down the Reset button.
- Wait 2 seconds until the US LED lights up red.
- Disconnect the Ethernet cable from the LAN connection. The US LED lights up green.
- Wait 2 seconds until the US LED lights up red.
- Reconnect the Ethernet cable to the LAN connection. The US LED lights up green.
- Wait 5 seconds until the US LED lights up red. Only then release the reset button.

The US LED flashes for 5 seconds. Then it illuminates as normal.

The IP address and the access rights are now defined until the next restart:

– IP address: 192.168.0.254
– Subnet mask: 255.255.255.0
– User name: admin
– Password: admin

You can now carry out diagnostics operations easily, and also at a later point in time. The device is still in “Alternative access” mode.

NOTE: Malfunction
If you now restart the device (power on/off), access is only possible via BootP or DHCP. To use the alternative access, you must again actuate the reset button locally on the device.

Saving the IP address permanently

- Check the parameters in the web-based management under “Configuration, Ethernet”.
- Click on “Transfer, Transfer configuration”.

⇒ The IP address has now been saved permanently.

TC EXTENDER 6004 ETH-2S

- Connect a PC to the **LAN3** connection of the device.
- Press and hold down the Reset button.
- Wait 2 seconds until the display illuminates.
- Disconnect the Ethernet cable from the LAN3 connection.
- Wait 2 seconds until the display illuminates.
- Reconnect the Ethernet cable to the LAN3 connection.
- Wait 5 seconds until the display illuminates. Only then release the reset button.

If you have exceeded the specified time, the message “Time-out” appears on the display. If this is the case, start over at step 1.

The IP address and the access rights are now defined until the next restart:

– IP address: 192.168.0.254
– Subnet mask: 255.255.255.0
– User name: admin
– Password: admin

You can now carry out diagnostics operations easily, and also at a later point in time. The device is still in “Alternative access” mode.

NOTE: Malfunction
If you now restart the device (power on/off), access is only possible via BootP or DHCP. To use the alternative access, you must again actuate the reset button locally on the device.

Saving the IP address permanently

- Check the parameters in the web-based management under “Configuration, Ethernet”.
- Click on “Transfer, Transfer configuration”.

⇒ The IP address has now been saved permanently.

6.4.3 Web-based management

6.4.3.1 Login page

Upon successful connection, the login page of the connected device opens.

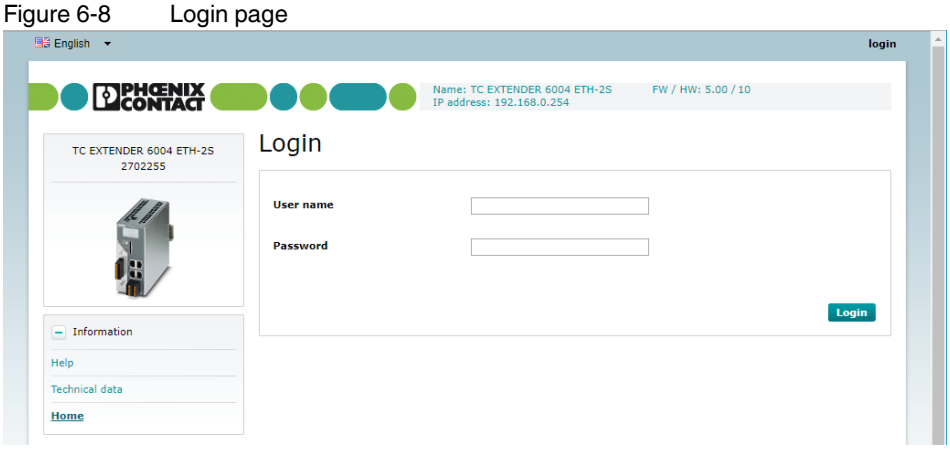
The web-based management has two access options:

- User
  - Limited read and write access, no user management function
  - User name: user
  - Password: user
- Administrator
  - Full read and write access, user management
  - User name: admin
  - Password: admin

The login page is also visible to guests. The administrator can hide login page content from guests.

- To hide the login page, log in as the administrator.
- Go to “Administration, User management, Access rights for guest”.

Figure 6-8 Login page



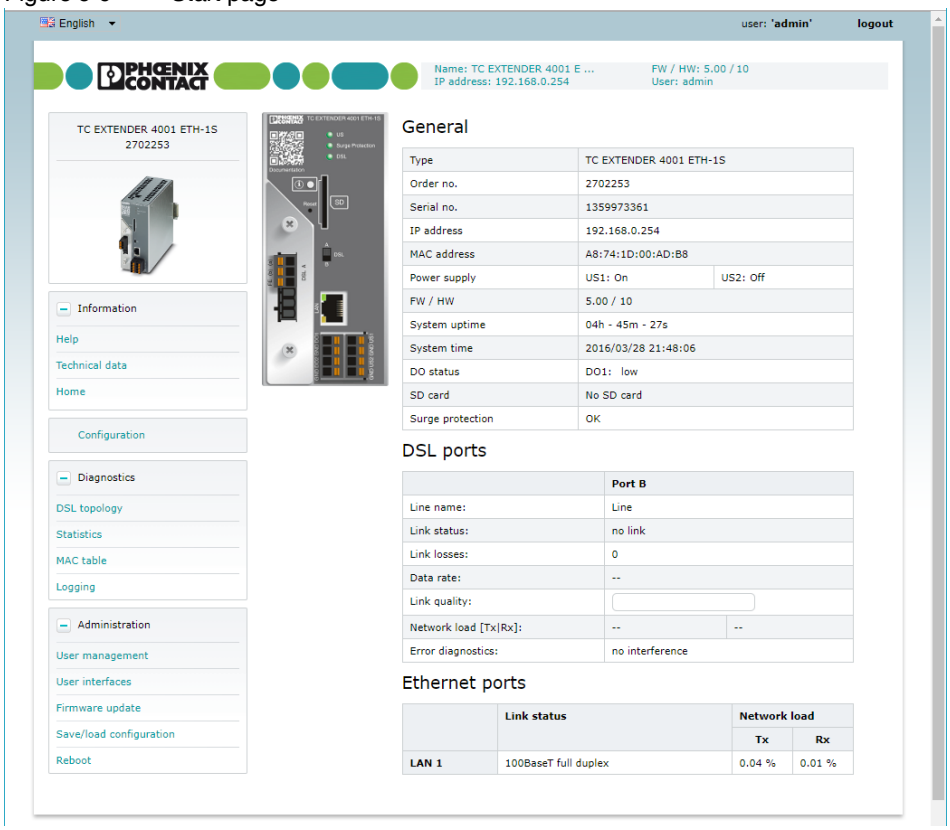
6.4.3.2 Start page

Upon logging in, the start page opens. The “Advanced configuration” menu is hidden by default. It contains:

– Switch station (LAN ports)
– Redundancy (RSTP)
– SNMP traps
– VLAN

- Log in as the administrator to display the “Advanced configuration” menu.
- Go to “Administration, User management, Setting page access rights for User management”.

Figure 6-9 Start page



6.4.3.3 Administration, User management

You can use this submenu to set the page access rights for the user roles.

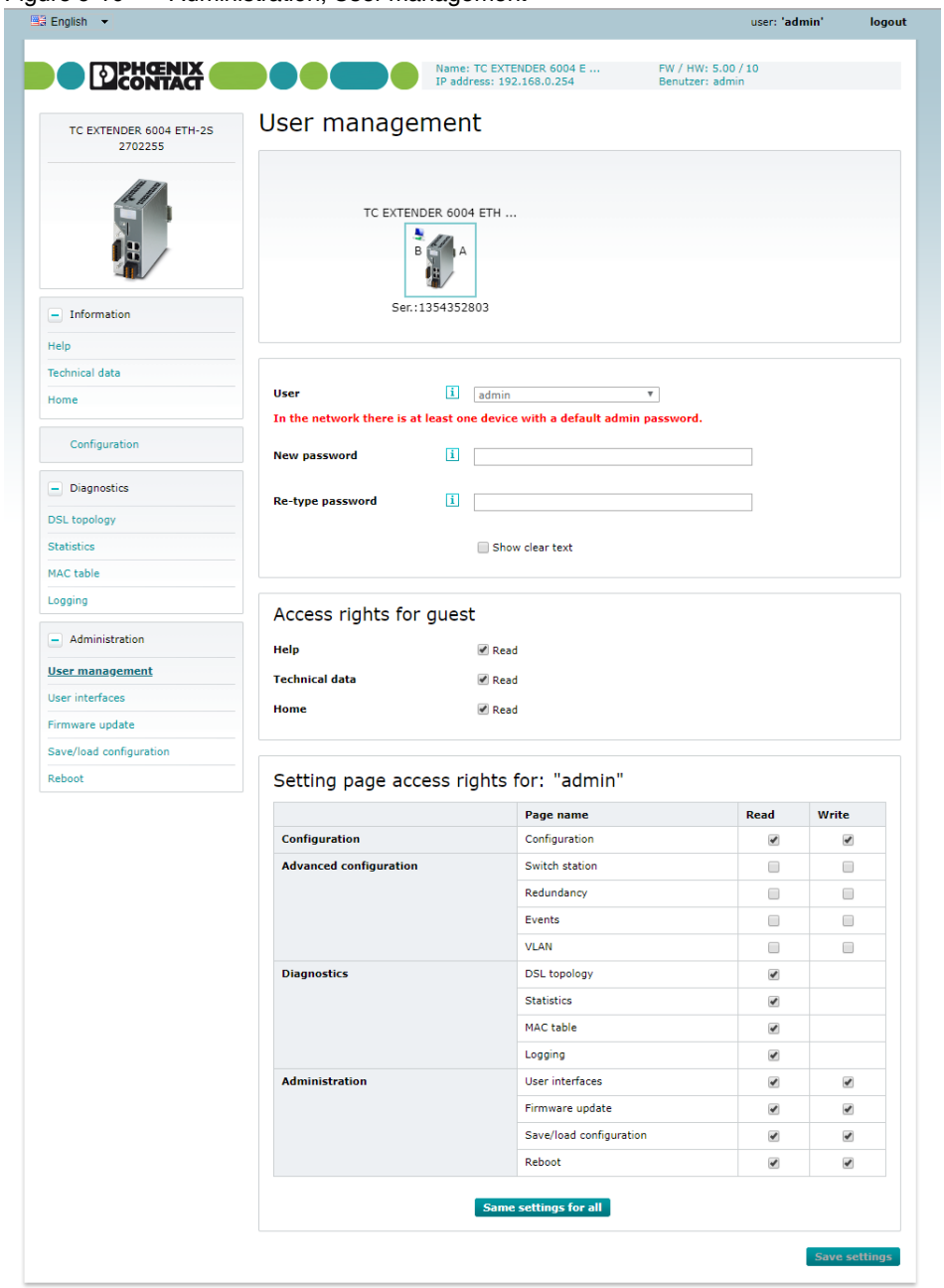
User roles:

- Guest: Read access to the login page
- User: User access, read and write access for all configuration and diagnostic functions
- Admin: Like a user, plus access to User management

Please note:

- The password for the admin user role protects the configuration rights of the respective device (device admin user role).
- You can assign write access to the “device user” user role via the “device admin” user role.
- If you want to be able to configure all Ethernet extenders in a segment unit centrally, the passwords for all “device admin” user roles have to be identical.
- The passwords of the individual “device user” user roles may differ, even if these users have write access.
- If you want to be able to transfer the locally assigned device user password or device admin password automatically to all devices available in the system, all “user” or “admin” user roles must have the same password (default state).
- If you want to assign individual device user role passwords to a device, the device must not be part of a segment unit.

Figure 6-10 Administration, User management



6.4.3.4 Administration, User interfaces

Web server

You can set the web server access here.

- Mode, HTTP (factory setting) or HTTPS
- Port, standard setting: 80
- Automatic web server logout, 300 ... 3,600 seconds, factory setting: 3,600

SNMP

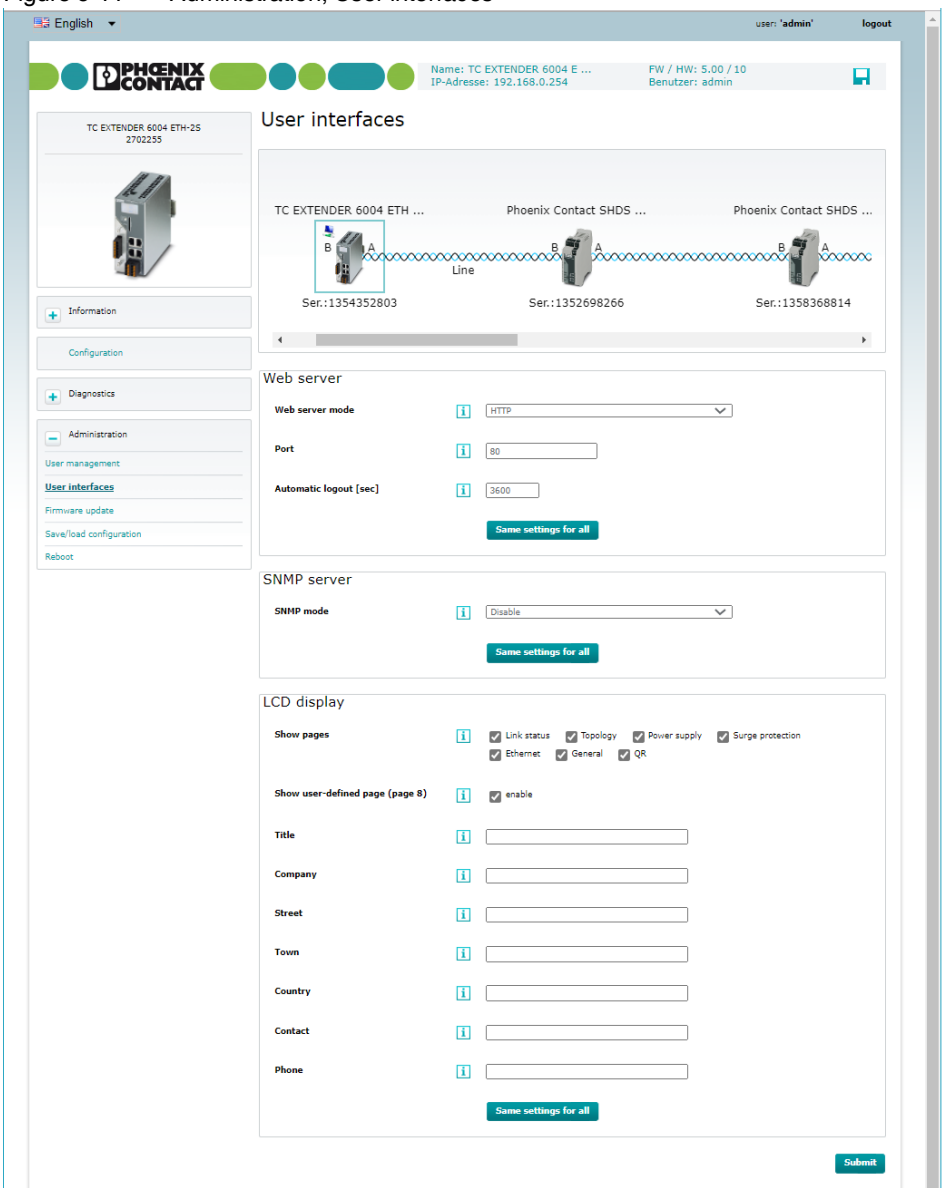
If you want to use SNMP, you must activate SNMP mode. Access is deactivated in the factory settings.

- SNMPv2
  - The read/write community must be used for access.
  - The SNMP read/write community strings are passwords that enable read/write access to device SNMP objects.
  - Length: 4 ... 12 characters
- SNMPv3
  - Security level: authPriv
  - Security name: admin
  - Authentication: SHA
  - Privacy: AES128
  - Authentication and Privacy are passwords that enable read/write access to device SNMP objects.
  - Length: 8 ... 16 characters

LCD display

You can activate or deactivate the LCD display here.

Figure 6-11 Administration, User interfaces

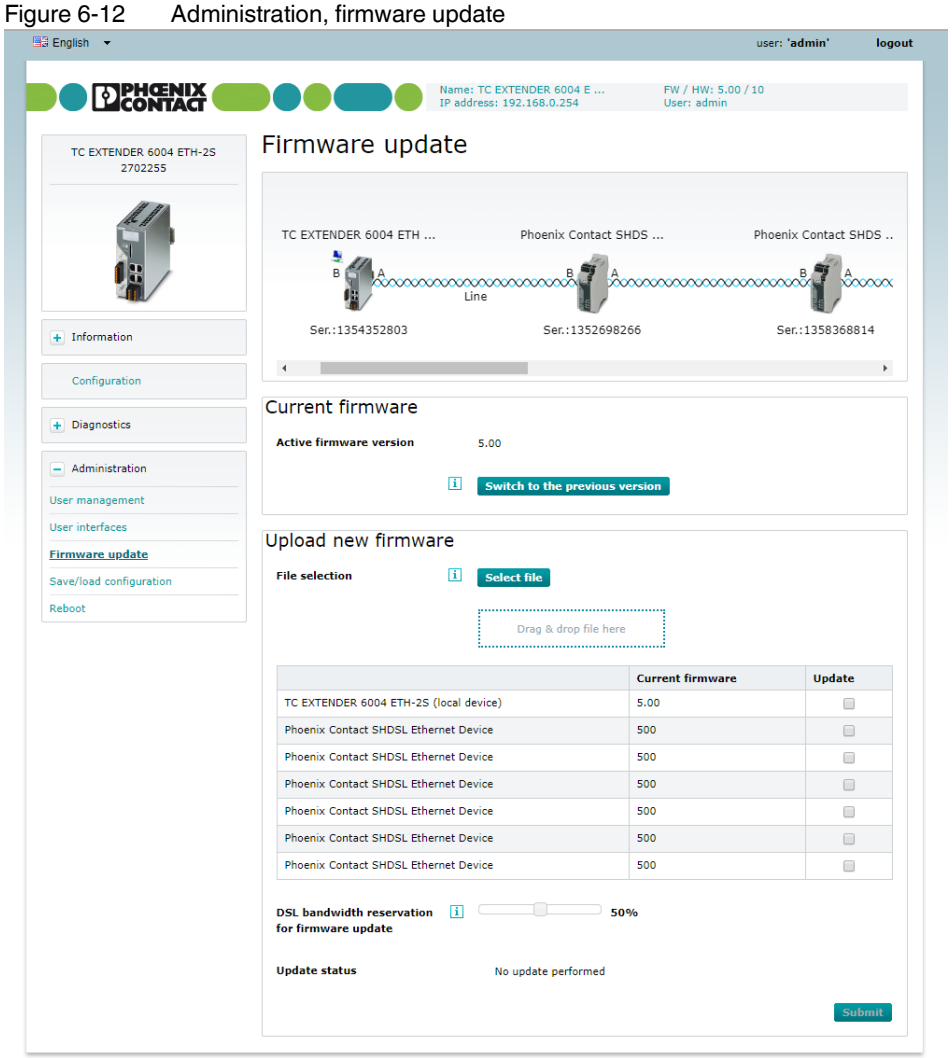


6.4.3.5 Administration, firmware update

You can use this menu to update the firmware of the local device or the remote devices.

You will find the latest firmware version at phoenixcontact.net/product/2702255. The TC EXTENDER 6004 ETH-2S firmware file also includes the TC EXTENDER 2001 ETH-2S firmware.

Figure 6-12 Administration, firmware update



6.4.3.6 Standard Configuration assistant

You can configure all standard settings via the Configuration assistant. You can either follow the steps specified or go directly to the desired tab.

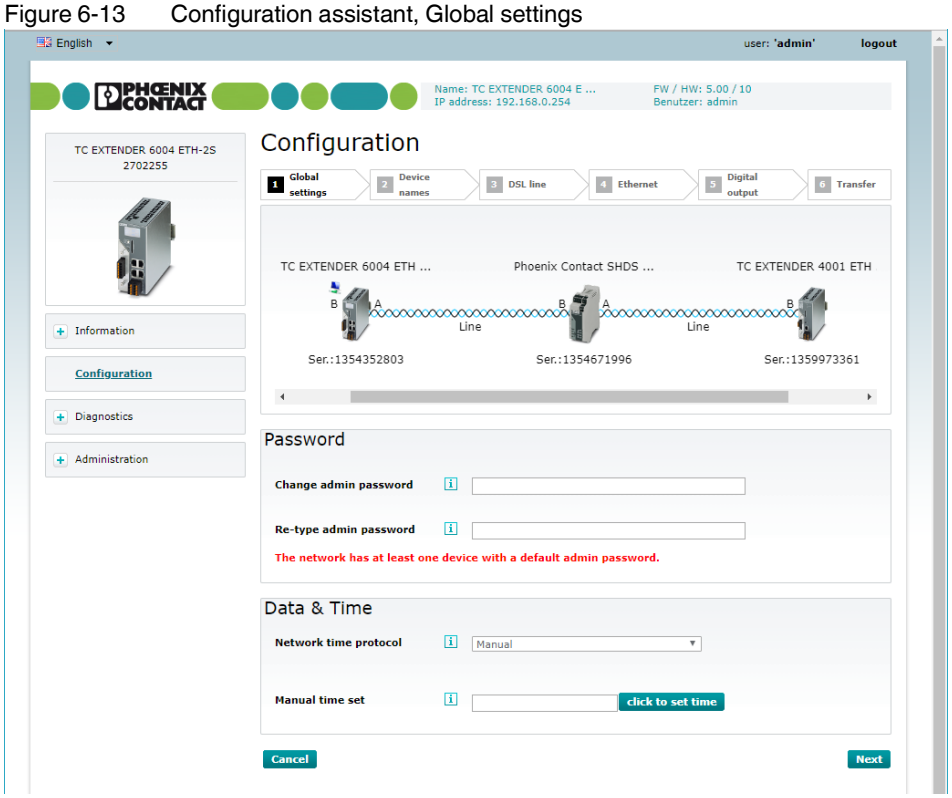
- To change settings, select a device in the topology.

Global settings

- Enter the desired system time.

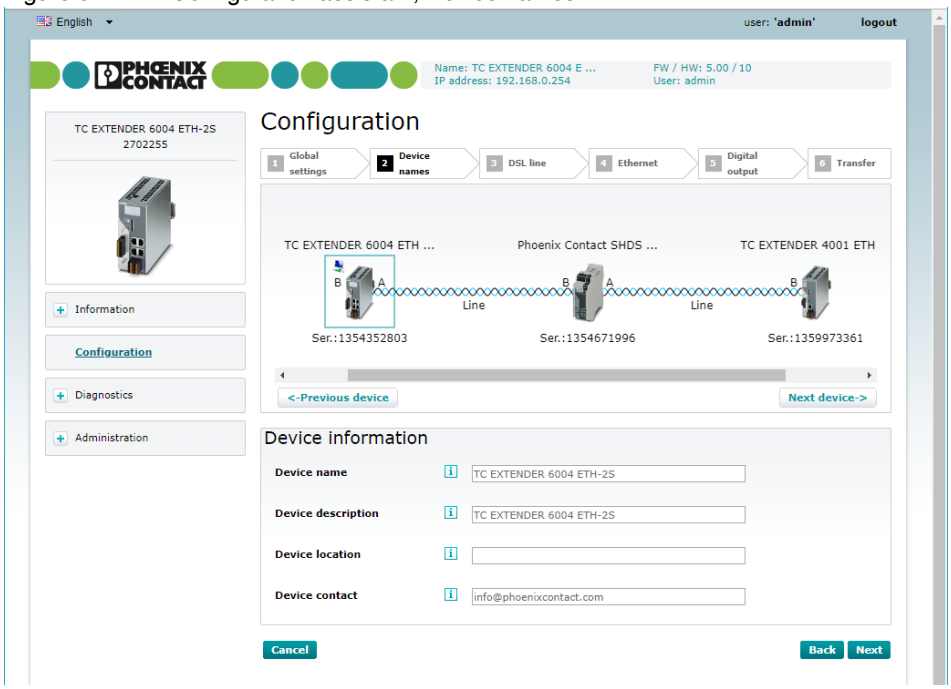
To be able to use the log files efficiently, enter the system time immediately during initial commissioning and after every power reset.

Figure 6-13 Configuration assistant, Global settings



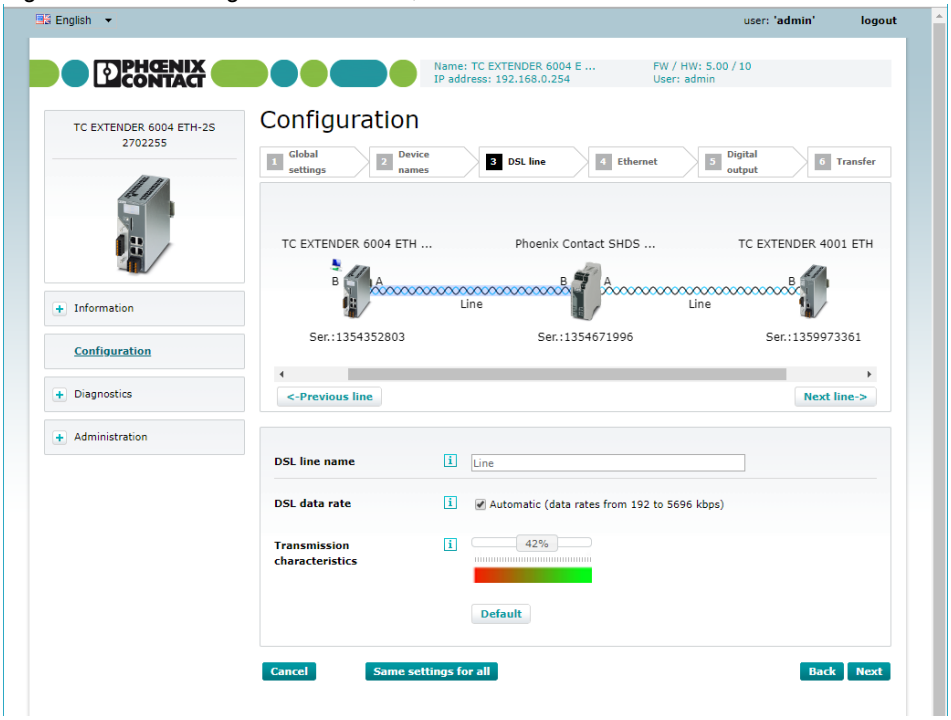
Device names

Figure 6-14 Configuration assistant, Device names



DSL line

Figure 6-15 Configuration assistant, DSL line

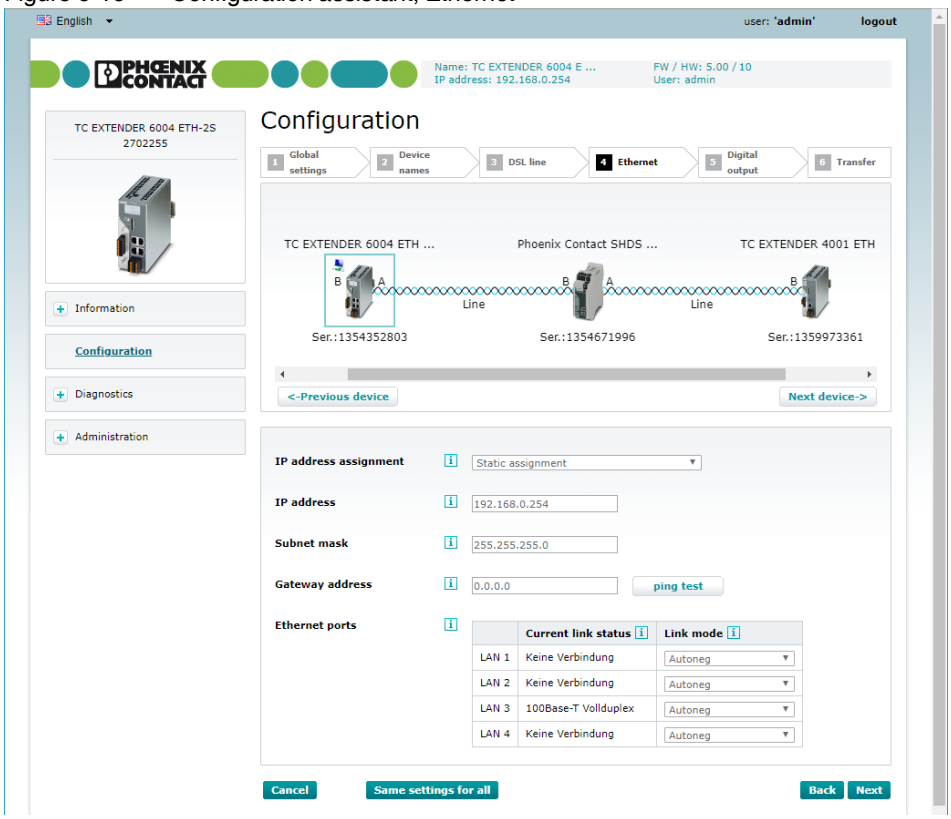


Ethernet

Enter the IP address and subnet mask here to enable access to the device web server (among other things).

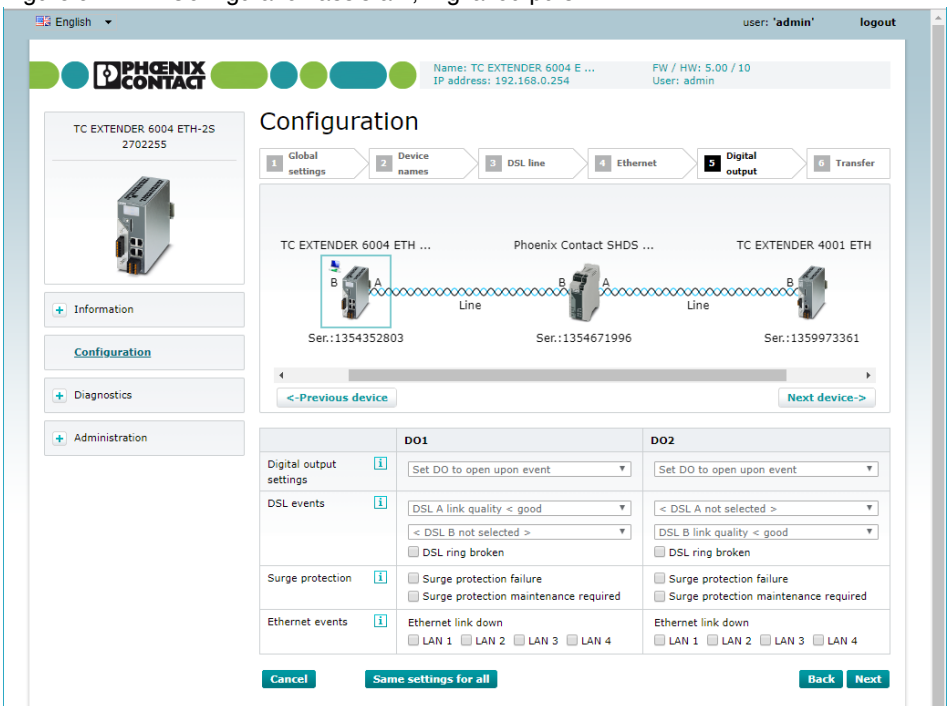
Standard setting: Alternating BootP/DHCP client

Figure 6-16 Configuration assistant, Ethernet



Digital outputs

Figure 6-17 Configuration assistant, Digital outputs



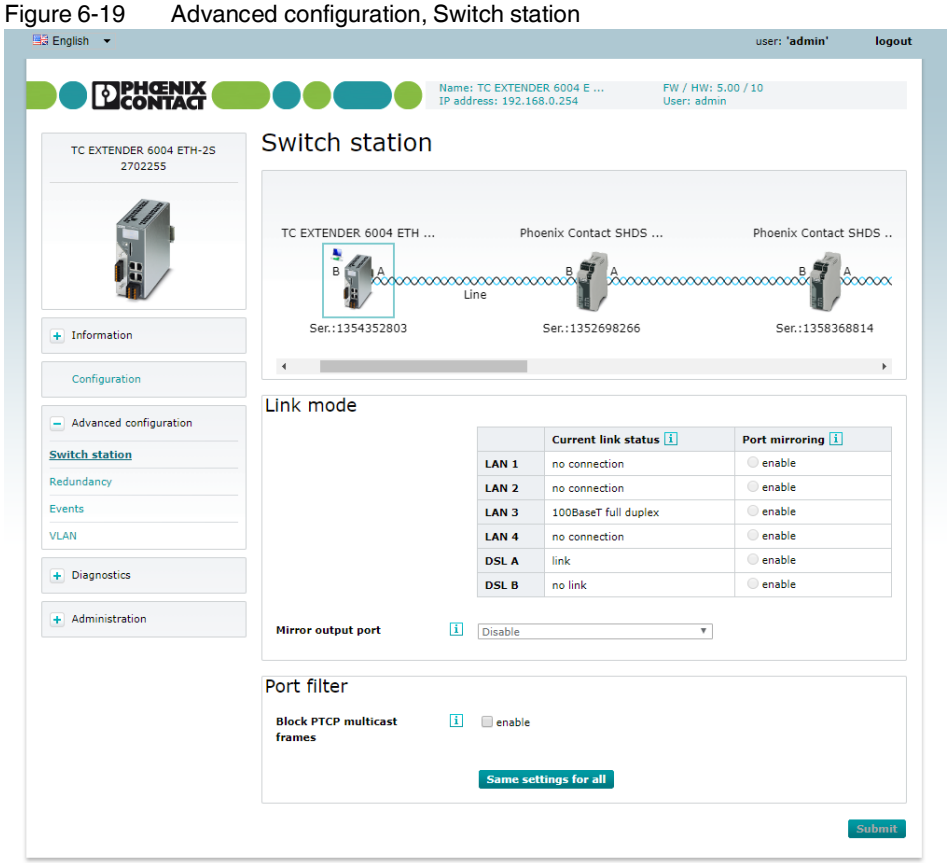
Transfer

Figure 6-18 Configuration assistant, Transfer

6.4.3.7 Advanced configuration

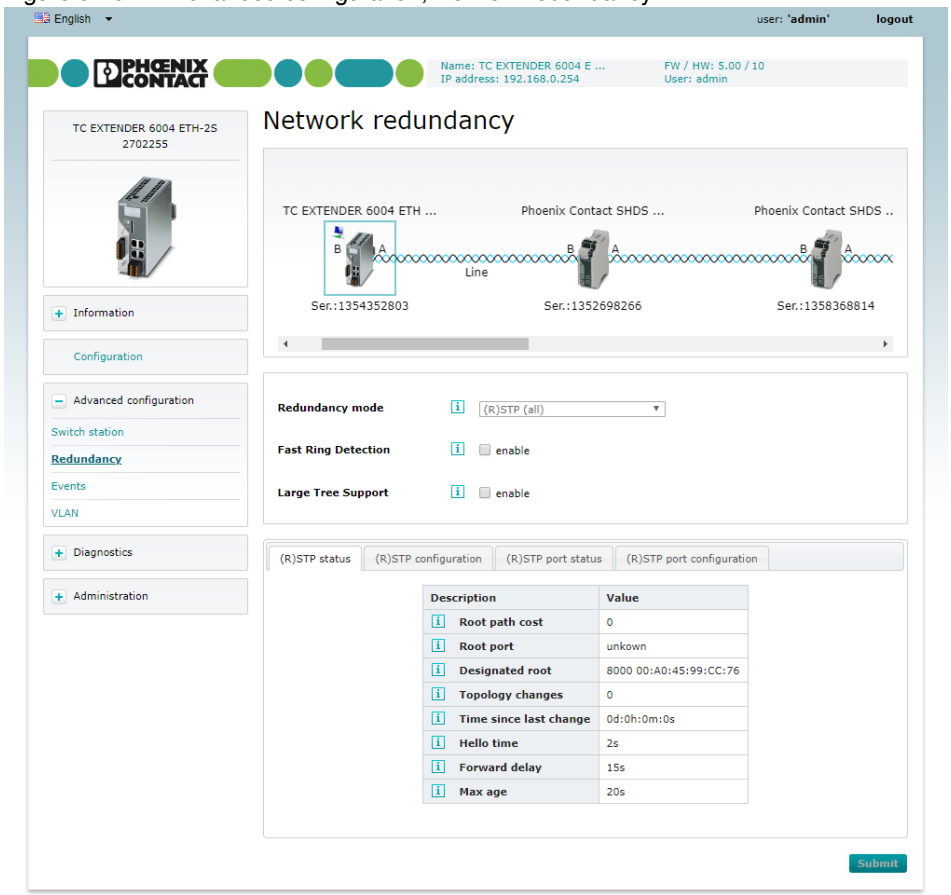
Switch station

Figure 6-19 Advanced configuration, Switch station



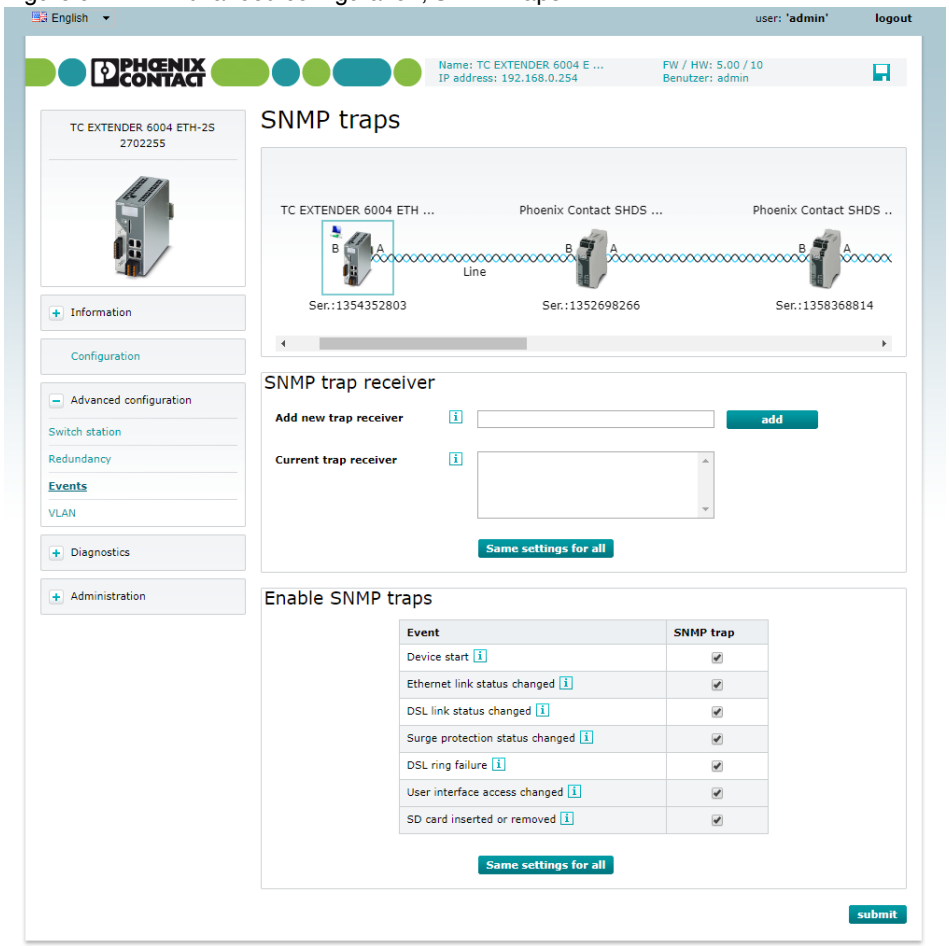
Network redundancy (RSTP)

Figure 6-20 Advanced configuration, Network redundancy



SNMP traps

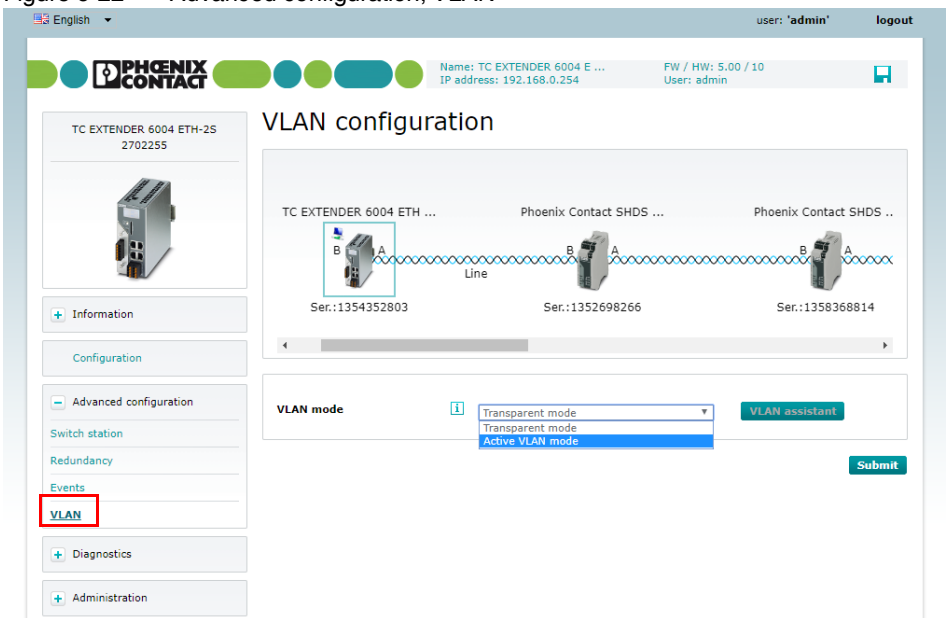
Figure 6-21 Advanced configuration, SNMP traps



VLAN

You will find information on configuring a VLAN in Section “Configuring VLAN” on page 55.

Figure 6-22 Advanced configuration, VLAN



6.4.4 SD card (<2 GB)

WARNING: Explosion hazard when used in potentially explosive areas!
Replacing the SD card is only permitted when the power is disconnected.

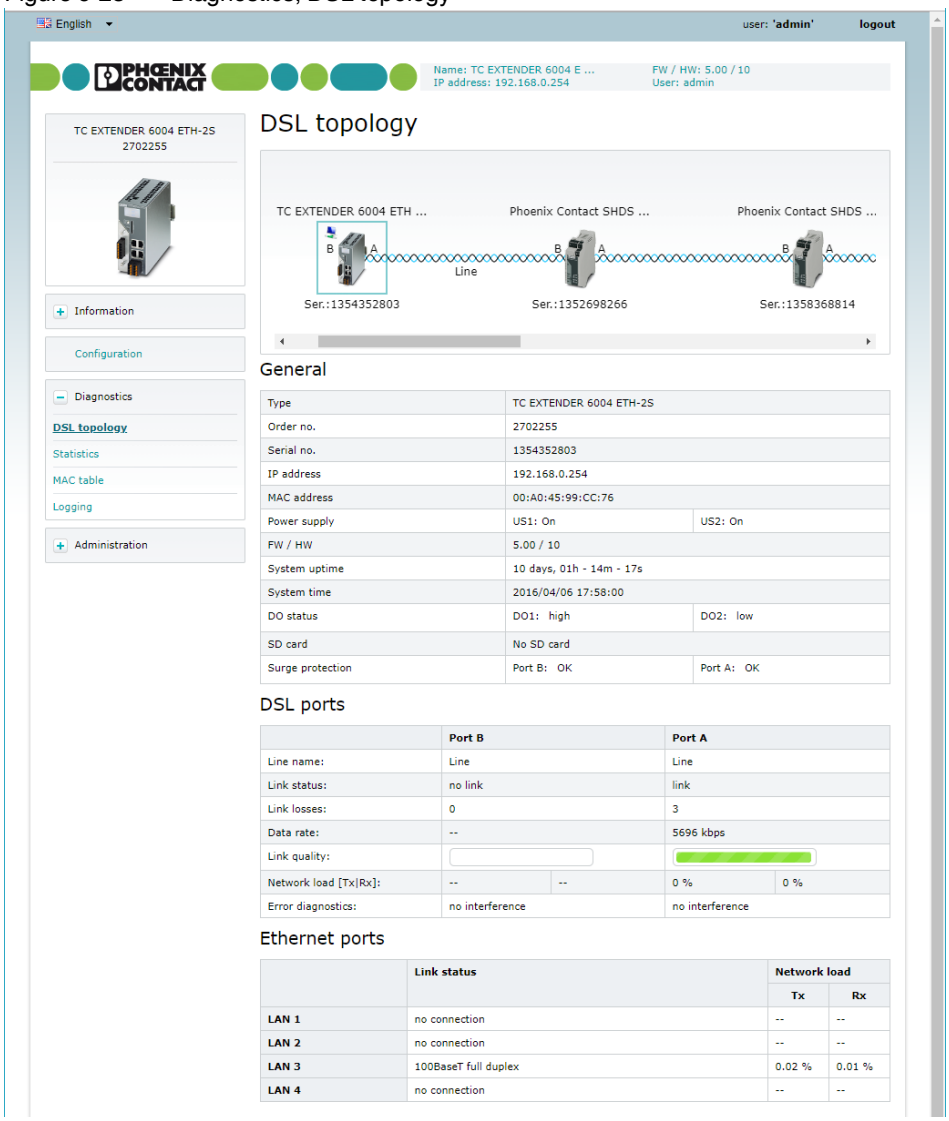
The customized configuration can be saved on an SD card. The SD card is not supplied as standard.

- Use the SD FLASH 512MB SD card, Item Number 2988146. It is qualified for industrial applications.
- In the web-based management, click on “Save/load configuration, Configuration up-load/download”.
- The configuration will be saved on your computer. Moreover, a copy will be stored on the SD card.
- Remove the SD card from the device.

6.5 Diagnostics via IP

6.5.1 DSL topology

Figure 6-23 Diagnostics, DSL topology

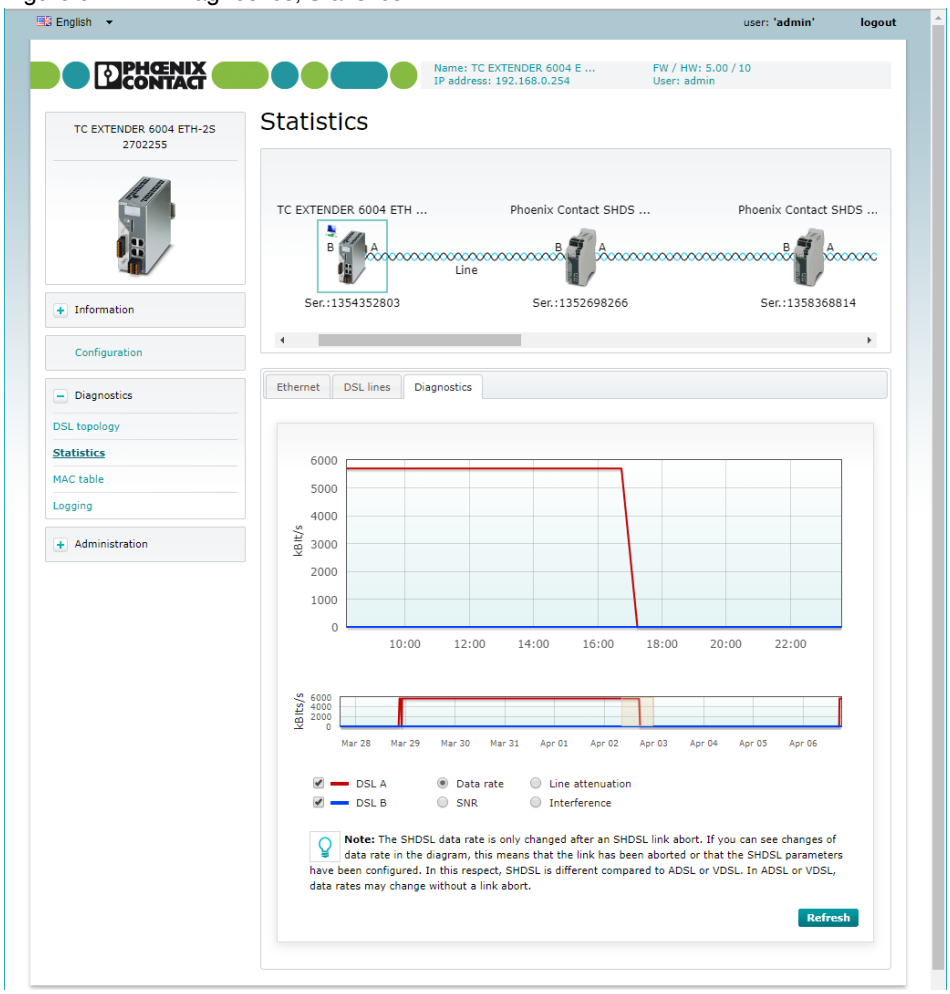


6.5.2 Statistics

The entire recorded time period is displayed in the lower window.

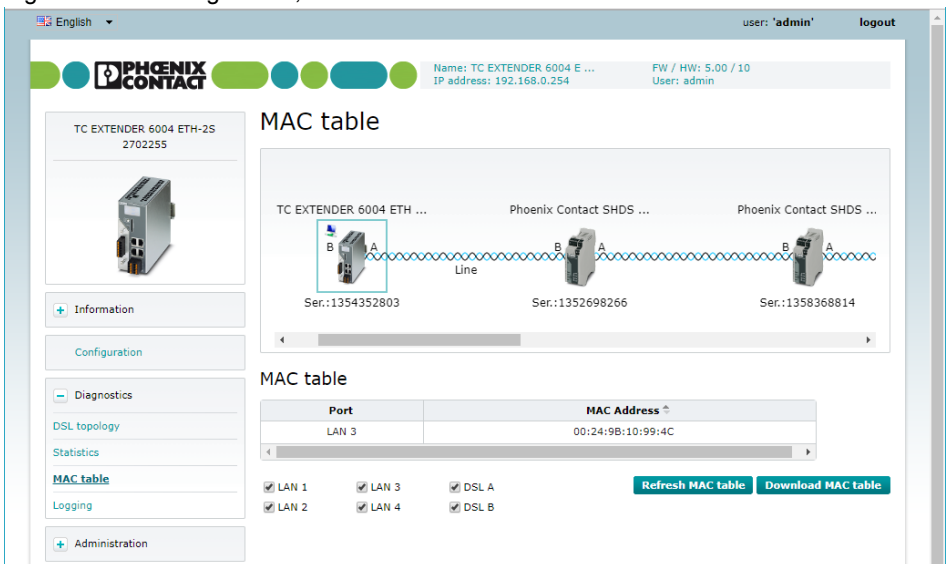
- Mark the event range that is to be displayed in detail in the upper window.

Figure 6-24 Diagnostics, Statistics



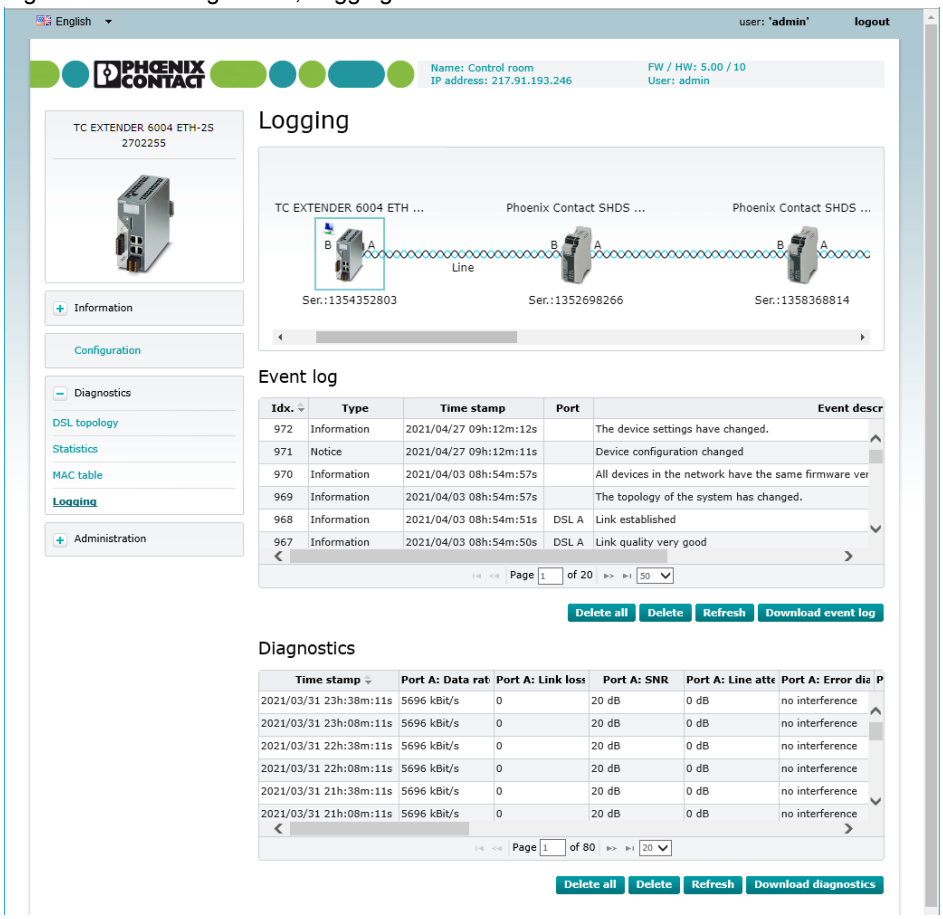
6.5.3 MAC table

Figure 6-25 Diagnostics, MAC table



6.5.4 Logging

Figure 6-26 Diagnostics, Logging



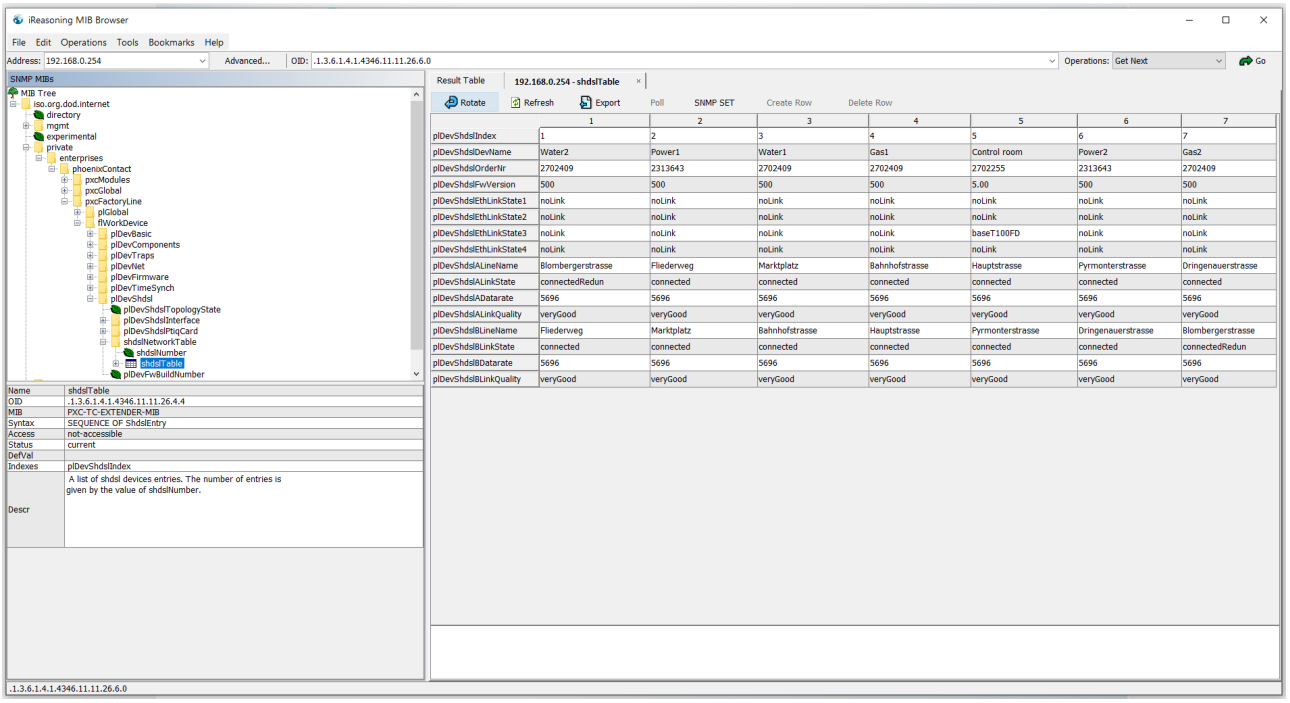
6.5.5 Diagnostics via SNMP

Via the IP address of the Managed Ethernet extender (in Figure 6-27: Device 5) you can display the states of all extenders, even those of the Unmanaged extenders without their own IP address. To do this, however, you must first load all the relevant MIBs into the MIB browser.

You will find the FW5.xx update package with the file EXTENDER_Private.MIB on our website at phoenixcontact.net/product/2702255.

- Then select the OID for the table (in Figure 6-27: shdslTable).

Figure 6-27 Diagnostics using the iReasoning MIB browser as an example



	1	2	3	4	5	6	7
plDevShdslIndex	1	2	3	4	5	6	7
plDevShdslDevName	Water2	Power1	Water1	Gas1	Control room	Power2	Gas2
plDevShdslOrderNr	2702409	2313643	2702409	2702409	2702255	2313643	2702409
plDevShdslFwVersion	500	500	500	500	5.00	500	500
plDevShdslEthLinkState1	noLink	noLink	noLink	noLink	noLink	noLink	noLink
plDevShdslEthLinkState2	noLink	noLink	noLink	noLink	noLink	noLink	noLink
plDevShdslEthLinkState3	noLink	noLink	noLink	noLink	baseT100FD	noLink	noLink
plDevShdslEthLinkState4	noLink	noLink	noLink	noLink	noLink	noLink	noLink
plDevShdslALineName	Blombergerstrasse	Fliederweg	Marktplatz	Bahnhofstrasse	Hauptstrasse	Pyrmonterstrasse	Dringenauerstrasse
plDevShdslALinkState	connectedRedun	connected	connected	connected	connected	connected	connected
plDevShdslADatarate	5696	5696	5696	5696	5696	5696	5696
plDevShdslALinkQuality	veryGood	veryGood	veryGood	veryGood	veryGood	veryGood	veryGood
plDevShdslBLineName	Fliederweg	Marktplatz	Bahnhofstrasse	Hauptstrasse	Pyrmonterstrasse	Dringenauerstrasse	Blombergerstrasse
plDevShdslBLinkState	connected	connected	connected	connected	connected	connected	connectedRedun
plDevShdslBDatarate	5696	5696	5696	5696	5696	5696	5696
plDevShdslBLinkQuality	veryGood	veryGood	veryGood	veryGood	veryGood	veryGood	veryGood

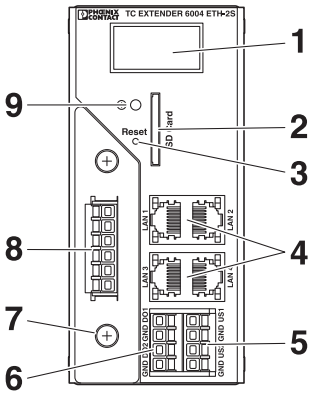
6.6 Display

The TC EXTENDER 6004 ETH-2S devices are equipped with a display. It helps you perform rapid diagnostics operations on site. Press the Info button to view important status and device information.

Change events are always displayed as warning messages on page 1, provided the event is current.

You can activate or deactivate each info page on the display. To do so, go to “User interfaces” in the web-based management.

Figure 6-28 Info button, position 9



6.6.1 Page 1, SHDSL connection

On this page, learn more about the connection status and the quality of individual DSL ports.

3-level quality display

The connection quality is determined based on the attenuation and the interference distance of the SHDSL line. It is independent of the data rate achieved or set.

- If the connection quality is only displayed with one bar, check the connection or reduce the SHDSL data rate.

Dynamic status indicator

The dynamic status indicator indicates the current connection status. If a connection is established, the SHDSL data rate is also displayed.

Diagnostics process

1 Only one device on the left side: No other devices found

2 Two devices: Other devices found

3 Status bars move between the devices: Initialization runs

4 Current data rate

6.6.2 Page 2, system topology

Here the current system topology is displayed as an example (point-to-point, line, or ring).

6.6.3 Page 3, supply voltage and digital outputs

The following are displayed on this page:

– Status of the connected supply voltage (US1 and US2)
– Status of digital outputs (DO1 and DO2)

6.6.4 Page 4, surge protection

See “TC EXTENDER 6004 ETH-2S” on page 48

6.6.5 Page 5, Ethernet parameters

Table 6-2 Ethernet parameters

Mode	IP mode (see page 59)
	DHCP client: Dynamic IP address, a DHCP server assigns the address.
	BootP: The address is obtained via BootP.
	Static: Fixed IP address
IP	IP address of the Ethernet extender
	Using this IP address, you can reach the web-based management of the Ethernet extender for diagnostics or configuration. To receive access to the web server (web-based management) with the specified IP address, you must match the computer’s IP address and subnet mask to the Ethernet extender. If the Ethernet extender works as a DHCP client, but no DHCP server is connected, no IP address will appear. If “BootP” is set, but an address has not been assigned yet, no IP address appears either. To access web-based management anyway in these scenarios, follow the instructions on page 59.
Mask	Subnet mask on the Ethernet extender
	This bit mask indicates how many bits make up the network prefix of an IP address. Together, the subnet mask and the IP address determine the address of a device in the network. The network prefix indicates which devices lie in a network and can communicate with each other. The network prefix is the same for all devices in one network.
Gateway	IP address of the entered default gateway
	The default gateway forwards all network requests that do not belong to the subnet to another subnet.

6.6.6 Page 6, general device information

On this page, you can see the device names, serial numbers, and hardware and firmware versions.

6.6.7 Page 7, link to documentation

Access the website with device documentation using the QR code.

6.6.8 Page 8, optional page

This page is deactivated in the delivery state. You can configure this page individually via the web-based management, for example to enter contact persons in the event of malfunctions.

7 Planning SHDSL networks

7.1 Data rate and range

A precise prediction of the maximum possible data rate is difficult in practice as many parameters play a role:

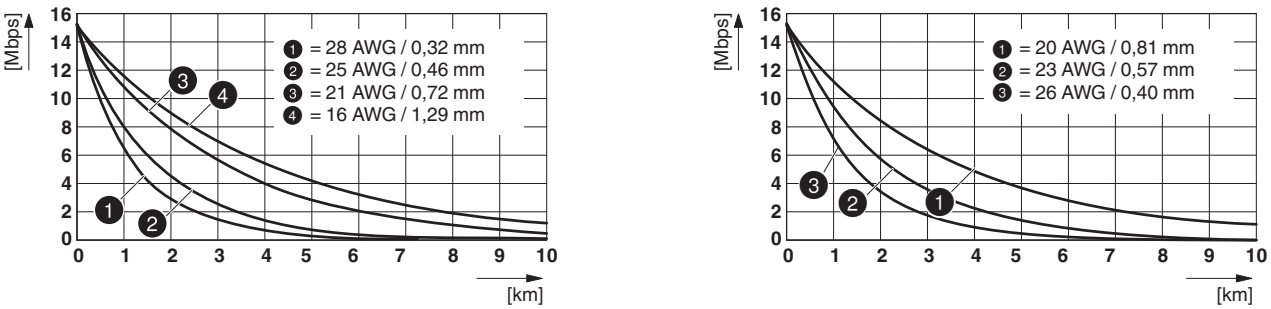
– Cable type (design, diameter, capacity, shielding)
– How it is laid (number of transitions, lines laid in parallel)
– EMC influences of neighboring devices on the communication line

For a new installation, we recommend using shielded twisted pair cables.

To gain an initial estimation of the possible data rate, use the following diagrams or the SHDSL Calculator software. It can be downloaded free of charge at phoenixcontact.net/product/2702409.

The actual data rate can only be determined in a practical test. To this end, Phoenix Contact provides test kits with two Ethernet extenders. This enables you to test the paths under realistic conditions.

Figure 7-1 Data rate depending on the distance, 2-wire



The maximum possible data rate is dependent on several parameters. Two important parameters are the cable length and cable cross section.

The diagrams illustrate the dependency of the maximum data rate on the line length with various cable types. Longer distances can be achieved using high-quality cables with larger diameters.

The industrial Ethernet extenders support data rates of 32 kbps to 15.3 Mbps in 2-wire operation. In 4-wire operation, data rates of up to 30 Mbps are possible. The Ethernet extenders are suitable for in-house cables, not for public telephone networks. Establishing the connection between the devices usually takes around one minute.

7.2 Topologies

- You can freely combine Unmanaged and Managed Ethernet extenders in the same system.
- You can operate the TC EXTENDER... devices with the old generation of devices in the same network:
  - PSI-MODEM-SHDS/ETH from firmware version 4.xx, Item No. 2313643
- For technical reasons, the devices **cannot** be combined with SHDSL extenders from other providers.

SHDSL extender segment

A segment is a point-to-point connection from SHDSL port A (client) to SHDSL port B (server). Open branch lines or branch lines to another segment are not permitted.

SHDSL extender segment unit

A segment unit consists of multiple point-to-point connections in a line or ring structure. In the SHDSL ring, a physical connection exists permanently between all extenders.

The system detects the path with the poorest SHDSL connection quality and switches it to the passive Ethernet Layer 2 level. In the event of a malfunction, this path is automatically activated again. Communication is maintained.

A segment unit can consist of a maximum of 50 devices. There are no limits to you connecting multiple segment units via Ethernet.

IP diagnostics

The Managed Ethernet extenders allow diagnostics via IP. However, diagnostics can only be performed for devices and paths belonging to their own SHDSL segment unit.

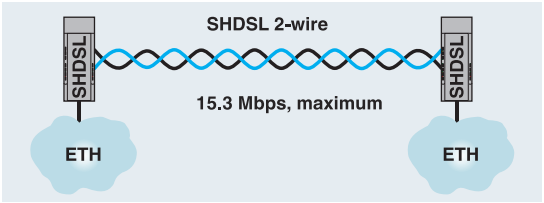
To perform diagnostics via IP on another SHDSL segment unit that is connected via Ethernet, this segment unit must also have at least one Managed Ethernet extender.

7.2.1 TC EXTENDER 4001 ETH-1S

You can only establish 2-wire connections with these devices.

– Maximum distance: 20 km

Figure 7-2 Point-to-point connection, 2-wire

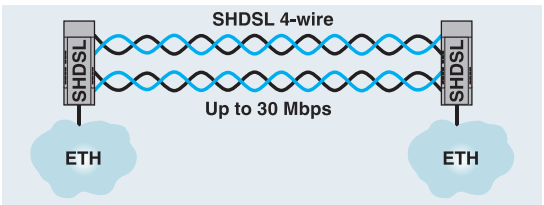


7.2.2 TC EXTENDER 2001 ETH-2S, TC EXTENDER 6004 ETH-2S

With these devices, you can also establish 4-wire connections and complex topologies. The Ethernet extenders automatically detect whether the established path is a 2-wire or 4-wire path.

If the devices have detected a 4-wire line, the transmission rate is automatically increased depending on the line quality. It is usually doubled. If one of the connections fails, the data is transmitted via the remaining conductors at single transmission speed. In this way, a reliable redundancy operation is supported.

Figure 7-3 Point-to-point connection, 4-wire



– Maximum distance between two devices in a line structure: 20 km

Figure 7-4 Line structure, 2-wire

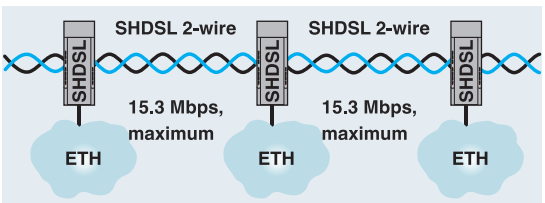
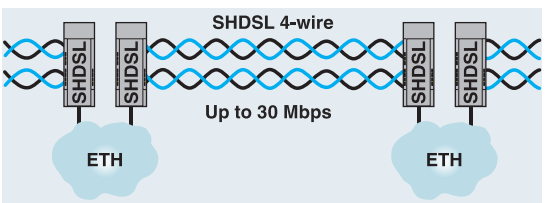


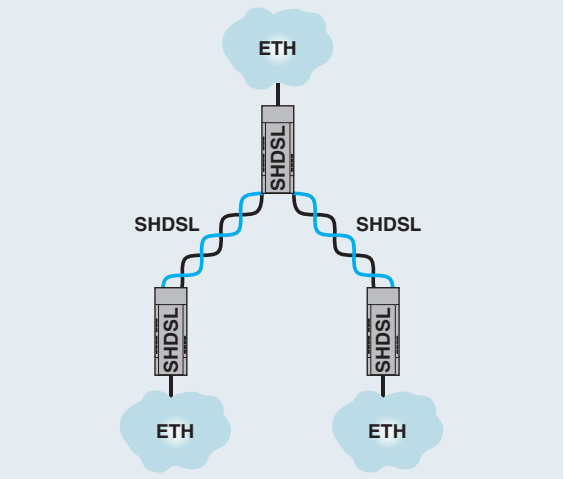
Figure 7-5 Line structure, 4-wire



Star structure

Since each device features two SHDSL ports, you need only three devices.

Figure 7-6 Star structure



Redundant ring

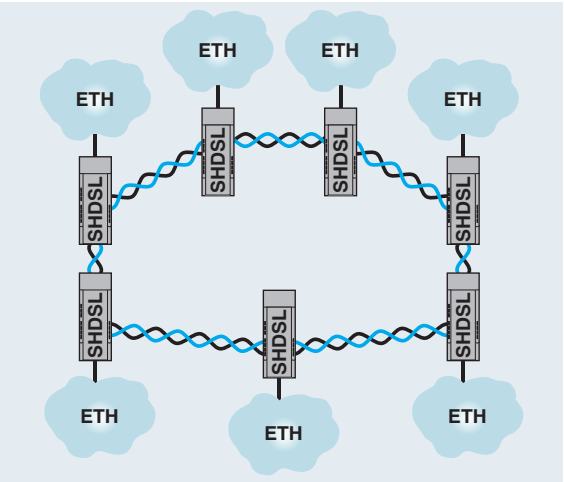
The overall availability of the system is significantly increased by a redundant ring. There can be a maximum distance of 20 km between two devices.

If there is a ring interruption, Ethernet communication is possible again after the following response time:

$t_{Recovery}$ = 1500 ms + number of devices x 100 ms

The paths of the SHDSL ring should show a very high connection quality during normal operation. If that is not the case, the reaction time can deviate from the value calculated above.

Figure 7-7 Redundant ring

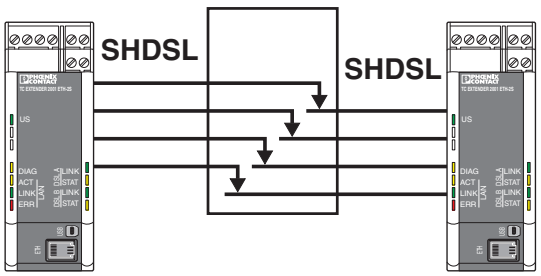


7.3 Slip ring communication

The TC EXTENDER 2001 ETH-2S and TC EXTENDER 6004 ETH-2S are also suitable for slip ring communication:

– The Ethernet extenders are connected via a 4-wire line. The connection is therefore redundantly established.
– Using the two digital outputs on the Ethernet extender, you can monitor the slip ring communication.

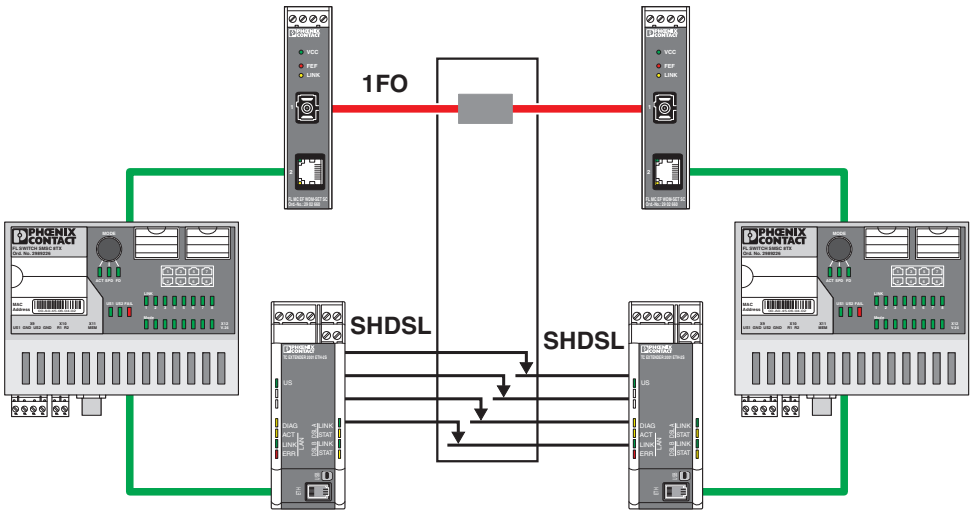
Figure 7-8 Slip ring communication in rotating applications



7.3.1 Redundant slip ring communication (TC EXTENDER 2001 ETH-2S only)

You can use the TC EXTENDER 2001 ETH-2S devices to establish redundant slip ring communication.

Figure 7-9 Redundant slip ring communication



In this example, a redundant network ensures data communication between the hub and the nacelle. Independent transmission paths are used for data communication.

With the use of fiber optic technology, standard Ethernet data transmission is based on two WDM media converters (e.g., FL MC EF WDM-SET SC, 2902660). For fiber optic transmission, an optical rotary transformer is integrated in the axis of the existing copper slip ring.

The redundant path is constructed with the aid of Ethernet extenders. The available copper slip ring is used for the SHDSL connection.

Redundancy management is ensured via Managed Switches. Phoenix Contact offers various RSTP-capable switches, e.g.:

– FL SWITCH 2408, 1043412
– FL SWITCH 2208, 2702327

8 Device replacement, device defects, and repairs

8.1 Device replacement

NOTE: device damage
Only mount and remove devices when the power supply is disconnected.

You can replace the device if necessary.

- Disconnect the device from the power supply.
- Remove all cables.
- Remove the device as described in 4.1.3 “Dismounting”.
- Replace the device with an identical device (the same Item No.).

8.2 Device defects and repairs

Repairs may only be carried out by Phoenix Contact.

- Send defective devices back to Phoenix Contact for repair or to receive a replacement.
- We strongly recommend using the original packaging to return the product.
- Include a note in the packaging indicating that the contents are returned goods.
- If the original packaging is no longer available, observe the following points:
  - Observe the humidity specifications and the temperature range specified for transport (see “Ambient conditions” on page 100).
  - Use dehumidifying agents if necessary.
  - Use suitable ESD packaging to protect components that are sensitive to electrostatic discharge.
  - Make sure that the packaging you select is large enough and sufficiently thick.
  - Only use plastic bubble wrap sheets as wadding.
  - Attach warnings to the transport packaging so that they are clearly visible.
  - Please ensure that the delivery note is placed inside the package if the package is to be shipped domestically. However, if the package is being shipped internationally, the delivery note must be placed inside a delivery note pocket and attached to the outside so that it is clearly visible.

9 Maintenance and disposal

9.1 Maintenance

The device is maintenance-free.

9.2 Disposal

The symbol with the crossed-out trash can indicates that this item must be collected and disposed of separately. Phoenix Contact or our service partners will take the item back for free disposal. For information on the available disposal options, visit phoenixcontact.com.

- Delete personal data before returning the item.
- Dispose of packaging materials that are no longer needed (cardboard packaging, paper, bubble wrap sheets, etc.) with household waste in accordance with the currently applicable national regulations.

10 Technical data

10.1 Ordering data

TC EXTENDER...	Type	Item No.	Pcs./Pkt.
Unmanaged Ethernet extender, distances of up to 20 km on in-house copper cables			
Point-to-point connections, line and ring structures, data rates up to 30 Mbps, diagnostics via USB and LEDs, 2 SHDSL ports, 1 LAN port	TC EXTENDER 2001 ETH-2S	2702409	1
Managed Ethernet extender, distances of up to 20 km on in-house copper cables, replaceable surge protection			
Point-to-point connections, data rates up to 15.3 Mbps, 1 SHDSL port, 1 LAN port, diagnostics via Ethernet	TC EXTENDER 4001 ETH-1S	2702253	1
Point-to-point connections, line and ring structures, data rates up to 30 Mbps, 2 SHDSL ports, 4-port switch, diagnostics via display and Ethernet	TC EXTENDER 6004 ETH-2S	2702255	1

10.2 Accessories

Power supply	Type	Item No.	Pcs./Pkt.
Primary-switched power supply, QUINT POWER, screw connection, DIN rail mounting, input: single-phase, output: 24 V DC/2.5 A	QUINT4-SYS-PS/1AC/24DC/2.5/SC	2904614	1

Surge protection (see page 47)	Type	Item No.	Pcs./Pkt.
Replaceable surge protection module, two-wire protection for floating SHDSL cables, two-level protective circuit			
For TC EXTENDER 4001 ETH-1S, 1 SHDSL port	TC EXTENDER PT-IQ-1S	2702257	1
For TC EXTENDER 6004 ETH-2S, 2 SHDSL ports	TC EXTENDER PT-IQ-2S	2702258	1
Surge protection in accordance with Class E_A (CAT6A), for Gigabit Ethernet (up to 10 Gbps), token ring, FDDI/CDDI, ISDN, DS1. Suitable for Power over Ethernet (PoE+) “Mode A” and “Mode B”, RJ45 intermediate plug with separate grounding cable and ground connection snap-on foot for NS 35 DIN rails	DT-LAN-CAT.6+	2881007	1
Intermediate plug with surge protection for two SHDSL telecommunications interfaces (ports). Connection: RJ45 (RJ12/RJ11) and plug-in screw terminal block (COMBICON). Alternatively, can be snapped onto a DIN rail.	DT-TELE-SHDSL	2801593	1

Patch cables and USB cables	Type	Item No.	Pcs./Pkt.
Patch cable, CAT5, pre-assembled			
0.5 m	FL CAT5 PATCH 0,5	2832263	1
5 m	FL CAT5 PATCH 5,0	2832580	1
Security element for RJ45 FL patch cable	FL PATCH SAFE CLIP	2891246	20
CAT5 SF/UTP cable, heavy-duty installation cable 2 mm^2 x 2 mm^2 x 0.22 mm^2, assembled on both sides with RJ45 connector, crossover or line	FL CAT5 HEAVY CONF/	2744827	1
RJ45 connector, degree of protection: IP20, number of positions: 8, 1 Gbps, CAT5 (IEC 11801:2002), material: PA, connection method: IDC fast connection, connection cross-section: AWG 26-23, cable outlet: straight, color: RAL 7042 (traffic gray A), Ethernet	VS-08-RJ45-5-Q/IP20	1656725	1
USB connecting cable: USB connector type A to USB connector type mini-B; length: 3 meters	CABLE-USB/MINI-USB-3,0M	2986135	1

Shield-connection clamp	Type	Item No.	Pcs./Pkt.
For applying the shield on busbars, for TC EXTENDER 2001 ETH-2S	SKS 8-SNS35	3062786	10

10.3 Technical data

Supply	...2001 ETH-2S	...4001 ETH-1S	...6004 ETH-2S
Connection method	COMBICON plug-in screw terminal block	Push-in spring connection	
Supply voltage range	18 V DC ... 30 V DC	10 V DC ... 60 V DC	
Nominal supply voltage	24 V DC ±5%	24 V DC ±5%	
	5 V DC (configuration only, via mini-USB type B)	-	-
Current consumption, typical			
60 V DC	-	80 mA	90 mA
24 V DC	<180 mA	200 mA	200 mA
10 V DC	-	380 mA	450 mA
Maximum current consumption for operation in a joining station, via the DIN rail connector	≤2 A	-	-
Electrical isolation	VCC // Ethernet // DSL (A) // DSL (B) // FE	VCC // Ethernet // DSL (A/B) // FE	VCC // Ethernet // DSL (A) // DSL (B) // FE
Test voltage	1.5 kV AC (50 Hz, 1 min)	1.5 kV AC (50 Hz, 1 min)	
Test voltage in accordance with EN/IEC 60079-7	500 V AC	500 V AC (observe the limitations in the specific conditions of use)	
Device protection	Varistor (voltage limitation) Series diode (protection against polarity reversal)	External protection of the suppressor diodes recommended in the supply voltage input: <6 AT per supply line, maximum terminal current: 12 A Available, internal device protection: 5 AT Protection against polarity reversal via series diode	

Ethernet interface, 10/100Base-T(X) in accordance with IEEE 802.3	...2001 ETH-2S	...4001 ETH-1S	...6004 ETH-2S
Connection method	RJ45 jack, shielded		
Number of ports	1		4
Function	Auto negotiation		Auto negotiation, auto crossing
Serial transmission speed	10/100 Mbps		
Transmission length	<100 m (twisted pair, shielded)		
Supported protocols	Protocol-transparent for TCP/IP, IPv4, and IPv6	IPv4, IPv6, TCP/IP, HTTP, HTTPS	
Secondary protocols	-	ARP, DHCP (client), PING, SNMP	

SHDSL interface in accordance with ITU-T G.991.2.bis	...2001 ETH-2S	...4001 ETH-1S	...6004 ETH-2S
Connection method	COMBICON plug-in screw terminal block	Push-in spring connection	
Serial transmission speed			
2-wire operation		32 kbps … 15.3 Mbps	
4-wire operation	64 kbps … 30 Mbps	-	64 kbps … 30 Mbps
Transmission length	<20 km (depending on data rate and conductor cross-section)		

USB 2.0	...2001 ETH-2S	...4001 ETH-1S	...6004 ETH-2S
Connection method	Mini-USB type B, 5-pos.	-	-
Transmission length	<100 m (twisted pair, shielded)	-	-

Surge protection of the SHDSL interface	...2001 ETH-2S	...4001 ETH-1S	...6004 ETH-2S
IEC test classification	-	B1 C1 C2 C3 D1	
Nominal pulse current I_{an} (10/1000) µs, core-core/core-ground	-	100 A/100 A (B1)	
Nominal discharge current I_n (8/20) µs, core-core/core-ground	-	1 kA/1 kA (C1, 300 pulses) 5 kA/5 kA (C2, 10 pulses) 100 A/100 A (C3, 300 pulses)	
Total surge current (8/20) µs, core-ground	-	9 kA (C2)	
Pulse discharge current I_{imp} (10/350) µs, core-ground	-	500 A (D1)	
Overvoltage category	-	II	
Pollution degree	-	2	

Digital output	...2001 ETH-2S	...4001 ETH-1S	...6004 ETH-2S
Connection method	COMBICON plug-in screw terminal block	Push-in spring connection	
Number of outputs	2	1	2
Output signal voltage	18 V DC ... 30 V DC (depending on the operating voltage)	10 V DC ... 60 V DC (24 V DC, depending on the operating voltage)	
Output signal current	≤150 mA Short-circuit-proof	≤500 mA Short-circuit-proof	
Behavior of outputs	Deactivated for device supply via the DIN rail connector	-	-

Connection terminal blocks	...2001 ETH-2S	...4001 ETH-1S	...6004 ETH-2S
Connection method	COMBICON plug-in screw terminal block	Push-in spring connection	
Stripping length	7 mm	10 mm	
Tightening torque	0.56 Nm ... 0.79 Nm	-	-
Conductor cross-section			
Flexible	0.2 mm^2 ... 2.5 mm^2	0.2 mm^2 ... 2.5 mm^2	
Rigid	0.2 mm^2 ... 2.5 mm^2	0.2 mm^2 ... 1.5 mm^2	
Rigid AWG	24 ... 14	24 ... 16	

Ethernet extenders in accordance with ITU-T G.991.2	...2001 ETH-2S	...4001 ETH-1S	...6004 ETH-2S
Management	Plug-and-play, diagnostics via PSI-CONF software or web-based management (with managed Ethernet extenders only)	Web-based management (access to all managed and unmanaged Ethernet extenders of the segment unit, role-based user management) SNMPv2/v3	
Diagnostic functions	Topology overview Event and path diagnostics Log file	Web-based access to all managed and unmanaged Ethernet extenders of the segment unit SNMP traps Port mirroring	
Filter functions	VLAN	VLAN Extended multicast filtering	
Redundancy	Proprietary SHDSL redundancy protocol (managed and unmanaged Ethernet extenders)	RSTP Proprietary SHDSL redundancy protocol (managed and unmanaged Ethernet extenders)	
IP configuration	-	Static IP address DHCP client BootP (delivery state: alternating BootP/DHCP)	
Additional functions	-	FDCML support for communication with the FL Network Manager	
Max. number of VLANs	64	64	
Number of supported devices	≤50 (per SHDSL segment unit)	≤50 (per SHDSL segment unit)	

General data	...2001 ETH-2S	...4001 ETH-1S	...6004 ETH-2S
Assembly note	The product can be snapped onto all 35 mm DIN rails in accordance with EN 60715.		
Degree of protection	IP20		
Dimensions (W/H/D)	35 mm x 99 mm x 114,5 mm	60 mm x 130 mm x 160 mm	
Housing material	PA 6.6-FR gray	Aluminum/steel sheet DC01	
Vibration resistance in accordance with EN 60068-2-6/IEC 60068-2-6	5g, 10 Hz... 150 Hz, 2.5 h, in XYZ direction		
Shock in accordance with EN 60068-2-27/IEC 60068-2-27	15g		
MTTF (mean time to failure), SN 29500 standard			
Temperature 25°C, operating cycle 21%	711 years	577 years	506 years
Temperature 40°C, operating cycle 34.25%	308 years	300 years	260 years
Temperature 40°C, operating cycle 100%	125 years	128 years	110 years

Ambient conditions	...2001 ETH-2S	...4001 ETH-1S	...6004 ETH-2S
Ambient temperature			
Operation	-20°C ... 60°C (For restrictions for side-by-side installation, see Table 4-1)	-25°C ... 60°C	-25°C ... 60°C -25°C ... 0°C (display inactivity can occur, image changes may take several seconds) 55°C ... 60°C (display contrast may deteriorate)
Storage/transport	-40°C ... 85°C		
Permissible humidity			
Operation	10% ... 95%, non-condensing		
	-	-	<60% (at an ambient temperature >70°C)
Storage/transport	10% ... 95%, non-condensing		
Altitude (for restrictions, see the manufacturer's declaration for altitude operation)	≤5,000 m	≤2,500 m	

Approvals	...2001 ETH-2S	...4001 ETH-1S	...6004 ETH-2S
Compliance		CE-compliant	
ATEX Follow the special installation instructions in 1.4 “Safety notes”.	II 3 G Ex ec IIC T4 Gc PxCIF11ATEX-2313643X	II 3 G Ex ec IIC T4 Gc PxCIF16ATEX2702253X	
UKEX	II 3 G Ex ec IIC T4 Gc PxCIMA22UKEX2313643X	II 3 G Ex ec IIC T4 Gc PxCIMA22UKEX2702253X	
UL, USA/Canada	508 listed		
Corrosive gas test	ISA-S71.04-1985 G3 Harsh Group A		
Standards/regulations	EN 50121-4		

10.4 Compliance

10.4.1 TC EXTENDER 2001 ETH-2S

Compliance with EMC Directive 2014/30/EU		
Immunity in accordance with EN 61000-6-2		
Electrostatic discharge	EN 61000-4-2	
	Contact discharge	±6 kV
	Air discharge	±8 kV
	Indirect discharge	±6 kV
	Comment	Criterion B
Electromagnetic HF field	EN 61000-4-3	
	Frequency range	80 MHz ... 3 GHz
	Field strength	10 V/m
	Comment	Criterion A
Fast transients (burst)	EN 61000-4-4	
	Input	±2 kV
	Signal	±2 kV
	Comment	Criterion B
Surge current loads (surge)	EN 61000-4-5	
	Input	±0.5 kV (symmetrical/asymmetrical)
	Output	±1 kV (asymmetrical, unshielded)
	Signal	±1 kV (asymmetrical, shielded Ethernet cable)
		±1 kV (asymmetrical, line to ground, unshielded SHDSL cable)
	Comment	Criterion A
Conducted interference	EN 61000-4-6	
	Frequency range	0.15 MHz ... 80 MHz
	Voltage	10 V
	Comment	Criterion A

Criterion A	Normal operating behavior within the specified limits
Criterion B	Temporary impairment of operating behavior that is corrected by the device itself

Noise emissions in accordance with EN 61000-6-4	
Noise emissions in accordance with EN 55011	Class A, industrial applications

10.4.2 TC EXTENDER 4001 ETH-1S and TC EXTENDER 6004 ETH-2S

Compliance with EMC Directive 2014/30/EU		
Immunity in accordance with EN 61000-6-2		
Electrostatic discharge	EN 61000-4-2	
	Contact discharge	±6 kV
	Air discharge	±8 kV
	Indirect discharge	±6 kV
	Comment	Criterion B
Electromagnetic HF field	EN 61000-4-3	
	Frequency range	80 MHz ... 3 GHz
	Field strength	10 V/m
	Comment	Criterion A
Fast transients (burst)	EN 61000-4-4	
	Input	±2 kV
	Signal	±2 kV
	Comment	Criterion B
Surge current loads (surge)	EN 61000-4-5	
	Input	±0.5 kV (symmetrical, unshielded supply line)
		±1 kV (asymmetrical, unshielded supply line)
	Output	±1 kV (asymmetrical, unshielded)
	Signal	±1 kV (asymmetrical, shielded Ethernet cable)
		±4 kV (asymmetrical, line to ground, unshielded SHDSL cable)
		±2 kV (symmetrical, line to line, unshielded SHDSL cable)
	Comment	Criterion B
Conducted interference	EN 61000-4-6	
	Frequency range	0.15 MHz ... 80 MHz
	Voltage	10 V
	Comment	Criterion A

Criterion A	Normal operating behavior within the specified limits
Criterion B	Temporary impairment of operating behavior that is corrected by the device itself

Noise emissions in accordance with EN 61000-6-4	
Noise emissions in accordance with EN 55011	Class A, industrial applications

A Appendixes

A 1 List of figures

A 2 List of tables

Please observe the following notes

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