

R&S® UMS300

Monitoring and Direction Finding System

Operating Manual



3051.7901.02 – 06

This manual describes the following versions of the R&S®UMS300:

- R&S®UMS300 (3051.7701.K02 and 3051.7701.03)

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In this manual, the following abbreviations are used: R&S®xxx is abbreviated as R&S xxx.

Contents

| | | |
|----------|---|-----------|
| 1 | Characteristics | 7 |
| 1.1 | Introduction | 7 |
| 1.2 | Design | 8 |
| 1.3 | Description of the Individual Components | 9 |
| 1.3.1 | Receiver | 9 |
| 1.3.2 | GPS Receiver | 10 |
| 1.3.3 | System computer | 10 |
| 1.3.4 | Power Supply and Monitoring | 10 |
| 1.3.5 | Temperature and Voltage Control | 11 |
| 1.3.6 | Router | 11 |
| 1.3.7 | Direction Finder (Optional) | 11 |
| 1.3.8 | Antenna Selection Switch (Optional) | 12 |
| 1.3.9 | DC Feed for Active Antennas (Optional) | 12 |
| 1.4 | R&S UMS300 as Part of a Sensor Network | 12 |
| 1.5 | Specifications | 15 |
| 1.6 | Equipment and Accessories Supplied | 16 |
| 1.6.1 | Base Unit | 16 |
| 1.6.2 | Accessories Supplied | 16 |
| 1.6.3 | Recommended Accessories/Options | 16 |
| 1.7 | Ordering Information | 17 |
| 2 | Preparation for Use | 18 |
| 2.1 | Unpacking and Checking | 18 |
| 2.2 | Installation | 18 |
| 2.2.1 | Selecting the Location | 18 |
| 2.2.2 | Installation | 19 |
| 2.3 | System Overview | 21 |
| 2.4 | Cabling and Connection of External Components | 23 |
| 2.4.1 | Grounding | 23 |
| 2.4.2 | Power Supply | 23 |
| 2.4.3 | Ethernet-LAN Interface (X21 LAN) | 24 |
| 2.4.4 | Ethernet-WAN Interface (X20 WAN) and Setup of a Router for the Control Center | 26 |

| | | |
|----------|--|-----------|
| 2.4.5 | Assembly of the RJ-45 Connector Housing..... | 30 |
| 2.4.6 | Antennas..... | 31 |
| 2.4.7 | DC Feed for Active Antennas..... | 32 |
| 2.4.8 | Antenna Selection Switch..... | 32 |
| 2.4.9 | Fast Electronic Antenna Switch..... | 32 |
| 2.4.10 | Inserting a SIM Card for Connection via a Mobile Communications Network..... | 33 |
| 2.4.11 | Specifications of the Mobile Communications Antenna..... | 34 |
| 3 | Operation..... | 35 |
| 3.1 | Introduction..... | 35 |
| 3.2 | Switching the System On..... | 35 |
| 3.3 | Local Operation..... | 36 |
| 3.4 | Remote Operation..... | 36 |
| 3.5 | Access to the System Computer via Windows Remote Desktop (RDP)..... | 38 |
| 3.6 | Spectrum Monitoring Software R&S Argus..... | 39 |
| 3.7 | Operation via SCPI Commands..... | 39 |
| 3.7.1 | SCPI Commands..... | 39 |
| 3.7.2 | SCPI Commands of the R&S UMS300..... | 40 |
| 4 | Maintenance..... | 43 |
| 4.1 | System Computer..... | 43 |
| 4.1.1 | Access via Windows Remote Desktop..... | 43 |
| 4.1.2 | Connecting the Keyboard, Mouse and Monitor..... | 44 |
| 4.1.3 | Updating the R&S UMS300 Application..... | 45 |
| 4.2 | Receiver Firmware Update..... | 47 |
| 4.3 | Router..... | 51 |
| 4.3.1 | Winbox..... | 51 |
| 4.3.2 | Firmware Update..... | 53 |
| 4.3.3 | Modifying the Configuration..... | 54 |
| 4.3.4 | Resetting and Loading a Configuration..... | 55 |
| 4.4 | Checking the System Components..... | 56 |
| 4.4.1 | Checking the Internal Operating Voltages..... | 56 |
| 4.4.2 | Checking the System Computer..... | 58 |
| 4.4.3 | Checking the Ethernet Interface of the System Computer..... | 59 |
| 4.4.4 | Checking the Receiver..... | 59 |

| | | |
|------------|--|-----------|
| 4.4.5 | Checking the Router via X21 Ethernet-LAN and X20 Ethernet-WAN..... | 60 |
| 4.4.6 | Setting Up Access via X20 Ethernet-WAN..... | 61 |
| 4.4.7 | Checking the 3/4G Wireless Module..... | 62 |
| 4.5 | Opening the R&S UMS300..... | 64 |
| 4.6 | Checking the LEDs..... | 65 |
| 4.7 | Checking the Device Fuses..... | 67 |
| 4.8 | Resetting the Microcontroller..... | 68 |
| 5 | Annex..... | 70 |
| 5.1 | Block Diagrams..... | 70 |
| 5.2 | Interface Description..... | 70 |
| | Index..... | 77 |

1 Characteristics

1.1 Introduction

The R&S UMS300 is a compact spectrum monitoring and (optional) direction finding system for the frequency range between 20 MHz and 3.6 GHz (optional 9 kHz up to 6 GHz) based on the R&S EB500.

The system is designed for outdoor use and the built-in active cooling (or heating) ensures a constant temperature range inside the enclosure.

Up to four antennas can be connected to the system and up to two of the antennas can be supplied with built-in DC feeds (option). A fifth antenna terminal is provided for the HF option.

If necessary, the R&S UMS300 can be equipped with a fast antenna switch in order to perform fast scans over the entire frequency range.

The measurement results include an exact, GPS-generated timestamp so the R&S UMS300 can be used as a TDOA sensor.

The system does not have its own user interface. Instead, it is controlled by the R&S Argus system software and thus allows easy integration even into larger Argus monitoring and direction finding systems. The interface for controlling the system is provided by two Ethernet ports. If necessary for maintenance purposes, the integrated system computer can be accessed using Windows Remote Desktop.

The R&S UMS300 can be powered from either an AC or DC voltage source. For AC operation, an external power supply must be ordered as an accessory.

An integrated microcontroller is used to monitor various operating conditions such as voltages, currents and temperatures.

Using an integrated router, the R&S UMS300 can be connected to a private or public network in order to allow access from a control center. Either line-bound networks (e.g. Ethernet, DSL etc.) or radio networks (UMTS/LTE) can be used for this purpose, provided that an additional 4G module is installed. Using suitable protocols, the router provides mechanisms for encryption and for establishment of secure tunnels via public networks (IPSec, L2TP, GRE).

1.2 Design

All of the components of the R&S UMS300 are accommodated in a compact, weather-proof, climate-controlled housing that can be mounted on a mast or a wall.



Fig. 1-1: External view of R&S UMS300

All of the connectors are arranged on the bottom of the system.

The weatherproof housing provided for the R&S UMS300 includes an aluminum cover to protect against exposure to the sun. Means for mounting on a mast or wall are provided on the rear.

The main components of the system are the receiver, power supply, control PC with solid-state drive, GPS receiver, router with LAN switch and heating/cooling unit (Peltier element).

Optional extensions are the direction finder option, 1-out-of-4 antenna selection switch, 1-out-of-2 antenna selection switch, fast antenna switch, up to two DC feeds for powering active antennas and 3/4G radio module for the router.

For the base unit, R&S Argus is available in a basic version (R&S UMS30-SWB). In order to be able to control additional options, the R&S UMS30-SWE extension is required.

No antennas are included with the base unit; they must be purchased separately to meet the specific requirements of the application.

1.3 Description of the Individual Components

For block diagrams, see [chapter 5.1, "Block Diagrams"](#), on page 70.

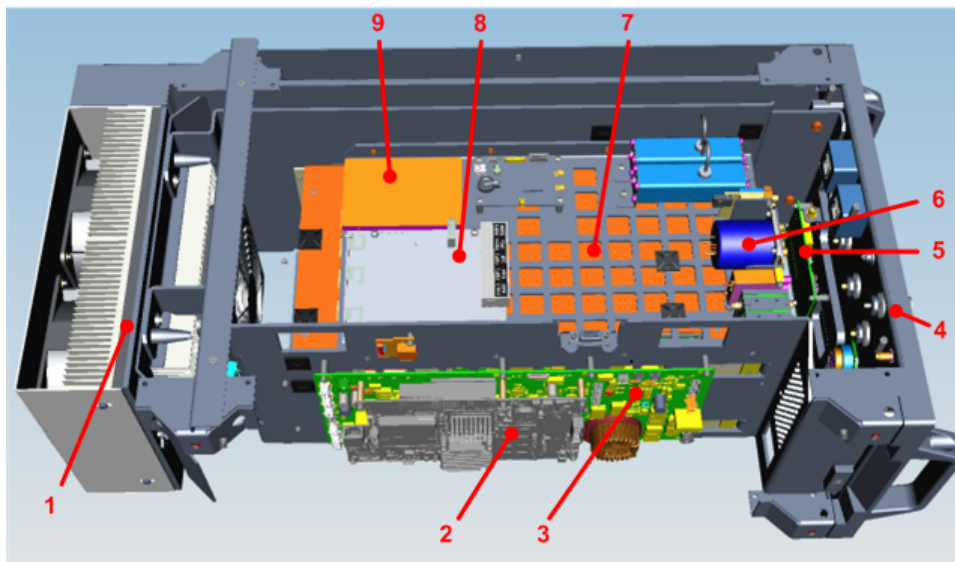


Fig. 1-2: Modules of the R&S UMS300

- 1 = Peltier element
- 2 = System computer
- 3 = Power control board
- 4 = Connection panel
- 5 = 3/4G modem
- 6 = Antenna selection switch
- 7 = Receiver
- 8 = Router
- 9 = SSD drive

1.3.1 Receiver

The receiver in the R&S UMS300 corresponds to the R&S EB500 Monitoring Receiver. The key characteristics are:

- Frequency range: 20 MHz to 3.6 GHz (extendable to higher frequencies up to 6 GHz using the optional R&S UMS30-FE and to lower frequencies up to 9 kHz using the optional R&S UMS30-HF)
- Fast panorama scan up to 12 GHz/s over entire frequency range up to 6 GHz
- IF spectrum of 1 kHz to 20 MHz and demodulation with bandwidths from 100 Hz to 5 MHz
- Polychrome IF spectrum for detection of pulsed signals
- Parallel monitoring of total of four signals
- Low power consumption

Detailed specifications and optional extensions are listed in the R&S EB500 data sheet.

1.3.2 GPS Receiver

An integrated GPS receiver fulfills three functions:

- Determination of the position of the R&S UMS300
- Generation of a precise timestamp for the measurement results (important when using the system as a TDOA sensor)
- Provision of a high-precision reference frequency

1.3.3 System computer

The system computer used in the R&S UMS300 is a "all-in-one" CPU board with state-of-the-art PC technology. It is equipped with a dual-core Intel Atom processor with 64-bit extension. A 480 GB solid-state drive (SSD) is connected via Serial ATA II.

The operating system is Microsoft Windows 7 Embedded (32-bit).

For maintenance purposes, the system computer has all of the interfaces needed to connect a keyboard, mouse and monitor (USB, VGA). However, the system must first be opened to access these interfaces. Only the two Gigabit Ethernet interfaces are externally accessible (X20, X21). They can be used to access the system computer. For further information see [chapter 4.1, "System Computer"](#), on page 43.

The R&S UMS300 has no direct user interface. The system is controlled via the network using the R&S Argus system software from an Argus control unit. For direct access to the system computer, it is possible to use Windows Remote Desktop.

Ex works the system computer has two IP addresses: 10.0.1.10 for communication with the outside world via the router and 192.168.29.10 for communication with the receiver. With the address 10.0.1.10 it can be accessed via the external connector X21 LAN if the connected device has an IP address in the subnetwork 192.168.0.0/24 and the connector is enabled for direct access (see ["Enabling the LAN port for maintenance or operation of an additional system device \(R&S FU129\)"](#) on page 24).

1.3.4 Power Supply and Monitoring

The R&S UMS300 is equipped with a DC power supply. For operation on AC power, an external power supply is available as an accessory.

The system is switched on by connecting it to the power supply. There is no on/off switch. The internal microcontroller ensures that all of the internal components are started up in the correct sequence.

If the system computer is shut down via the operating system and switched off, the microcontroller will switch the R&S UMS300 back on after some time has elapsed. This ensures that the system cannot be accidentally switched off and become inaccessible.

The system can be switched on only if the temperature and voltage are in their specified ranges.

1.3.5 Temperature and Voltage Control

A smart monitoring process ensures that

- The system is switched off if the input voltage is not in the proper range. If the voltage returns to the specified range, the system is switched on again.
- The system is switched off if the temperature is not in the proper range. Once the temperature returns to a satisfactory range, the system is switched on again.

A Peltier element integrated into the enclosure of the R&S UMS300 provides the heating and cooling functionality.

1.3.6 Router

The R&S UMS300 is equipped with a high-performance router. It has a total of five RJ45 Gigabit Ethernet ports, and three of these ports are configured as switch ports to form the internal LAN for the receiver and system computer. The third switch port is externally accessible (X21) and is used to connect an external computer for direct control of the R&S UMS300, to connect an additional system device (e.g. R&S FU129) or for maintenance purposes.

One of the router ports is configured as a WAN port and is externally accessible (X20). Ex works it is configured as DHCP client (automatic request and reception of an IP address), but it can also be set up for connection to DSL or for operation with static IP addresses.



The receiver cannot be accessed via the WAN port (X20). It shares an IP subnet with the system computer which is not routed via the WAN port and is thus accessible only from the system computer.

1.3.6.1 Wireless Module (UMTS/LTE) (Optional)

A 4G interface is available as an option. It allows connection of the R&S UMS300 to a control center additionally via fast mobile radio networks (UMTS/LTE).

The tunneling and encryption protocols (GRE, L2TP, IPSec) required in this case are thus made available.

1.3.7 Direction Finder (Optional)

The R&S UMS30-DF option is available to expand the R&S UMS300 into a powerful direction finder for signals up to 6 GHz.

The direction finder is based on the principle of correlative interferometry and corresponds in full to the R&S DDF205 direction finder. In the HF range, the direction finder uses the Watson-Watt method. The R&S ADD075 is used as the DF antenna.

Detailed specifications and optional extensions are listed in the R&S DDF205 data sheet.

1.3.8 Antenna Selection Switch (Optional)

The R&S UMS300 can be equipped with different combinations of HF inputs and antenna selection switches. The configuration of the switches must be defined when the system is ordered. The device will be manufactured and delivered with this specific configuration.

Three configurations are available:

- R&S UMS300 with 1 or 2 V/UHF inputs
- R&S UMS300 with 3 V/UHF inputs
- R&S UMS300 with 4 V/UHF inputs

Using the R&S Argus system software, the switch can be operated manually or automatically (R&S Argus AMM).

The switch options R&S UMS30-B1 and R&S UMS30-B2 are mechanical relays with 2 or 3 and 4 HF inputs, respectively.

The R&S UMS30-B3 option is a fast electronic switch with two inputs that can be controlled by the receiver via TTL. This makes it possible to perform very fast scans using two antennas.

1.3.9 DC Feed for Active Antennas (Optional)

The R&S UMS300 can be equipped with up to two power supply units for active antennas (DC feed).

Normally, the first DC feed will be internally connected at X1 and the second at X2 so that the DC voltage for antenna supply is available at the inner conductor of the relevant socket.

1.4 R&S UMS300 as Part of a Sensor Network

Ex works the R&S UMS300 is prepared for use in three different network scenarios:

1. The R&S UMS300 is connected via the WAN port X20 to other R&S UMS300 in a common transport network. The control PC is also connected to this common transport network. The WAN port of the R&S UMS300 obtains its IP address from a DHCP server located in the transport network.

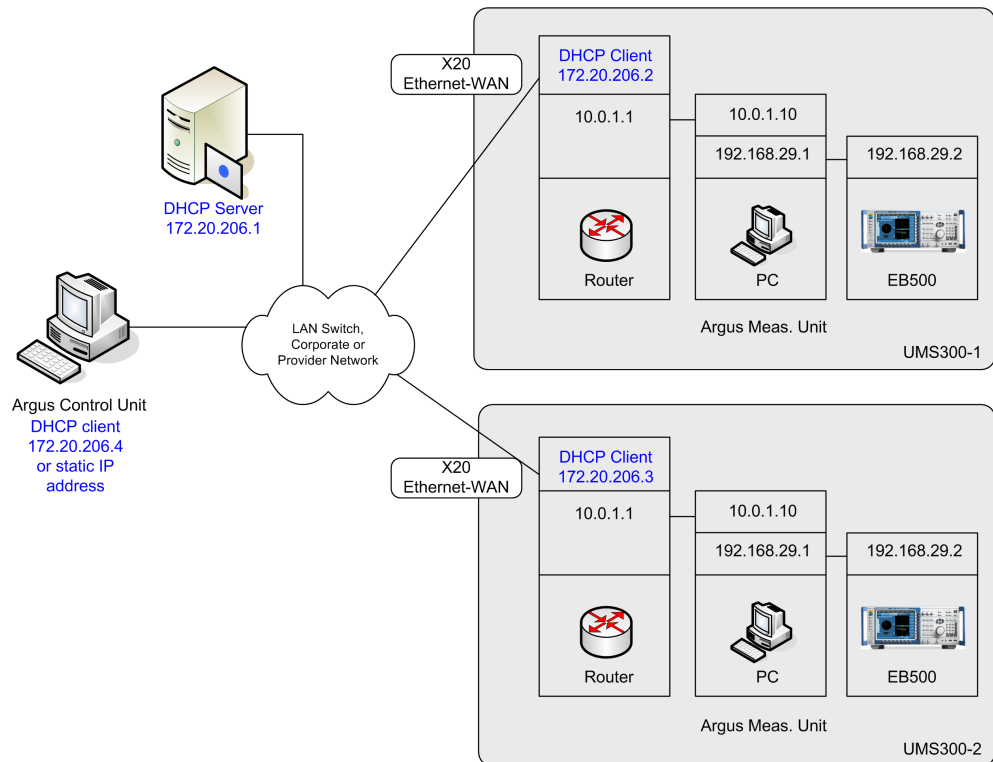


Fig. 1-3: Scenario 1: Connection via X20 Ethernet-WAN X20

2. The R&S UMS300 is controlled by a PC located e.g. in a control center behind the router, which is likewise connected to the common transport network. Also in this case the WAN port obtains its IP address via DHCP (the DHCP server may be installed on the router in the control center). In this configuration the traffic between control center and R&S UMS300 is encrypted.

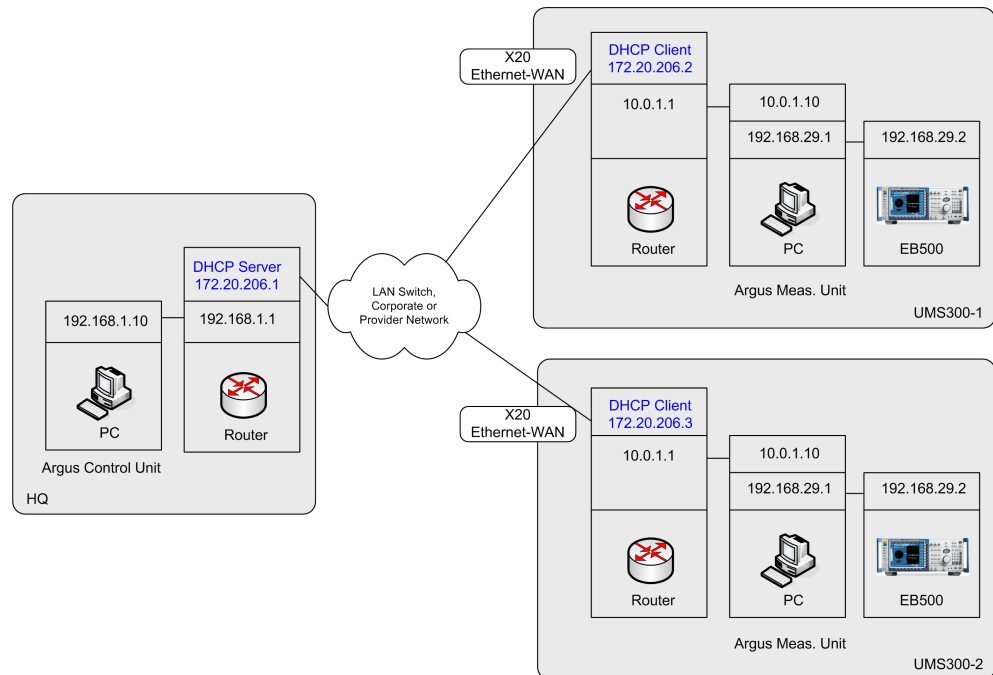


Fig. 1-4: Scenario 2: Connection control center - R&S UMS300 via X20 Ethernet-WAN (encrypted)

3. The R&S UMS300 is connected via the public 3/4G network to the Internet and is controlled by a PC in a control center. In the control center a router with Internet access and a static public IP address is required, serving as tunnel endpoint and VPN concentrator. In this case the routers obtain the public addresses for the WAN ports from the ADSL and mobile network provider. Again, the traffic between control center and R&S UMS300 is encrypted.

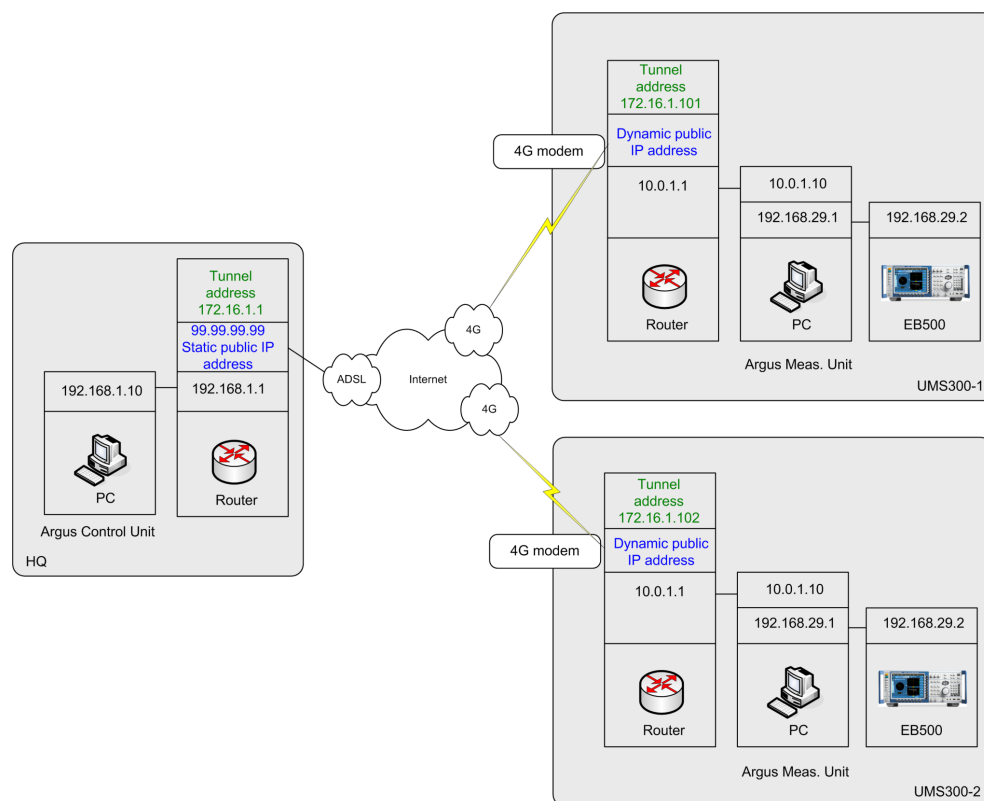


Fig. 1-5: Scenario 3: Connection control center - R&S UMS300 via 3/4G (encrypted)



For scenarios 2 and 3 an appropriately configured MikroTik router is required in the control center.

If you need assistance as you procure and set up this router, please contact your Rohde & Schwarz sales representative.

In case the Internet access in the control center is realized via ADSL, a user name and password must be entered in the router configuration. These data are to be obtained from the ADSL provider.

In case the R&S UMS300 is connected via 3/4G (scenario 2), the APN (Access Point Name) as well as the user name and password for access must be entered in the configuration of the R&S UMS300 router.

1.5 Specifications

All of the technical specifications, such as the electrical, mechanical and environment-specific specs can be found in the latest data sheet or in the current product brochure for the device.

1.6 Equipment and Accessories Supplied

1.6.1 Base Unit

- R&S EB500 receiver
- Power control board
- System computer
- Hard disk
- Router/switch
- GPS

1.6.2 Accessories Supplied

- DC power cord with bare leads on one end
- Clamp set for installation on a mast
- 2 x RJ-45 connector housing for watertight connection of standard LAN patch cables
- GPS antenna

1.6.3 Recommended Accessories/Options

- External AC power supply
- Direction finder option
- 3/4G wireless module
- 1-out-of-2 antenna selection switch
- 1-out-of-4 antenna selection switch
- Electronic antenna selection switch
- DC feed for active antennas
- R&S Argus base package R&S UMS30-SWB
- R&S Argus extension package R&S UMS30-SWE
- Monitoring and DF antennas
- HF option R&S UMS30-HF for R&S EB500 (corresponds to R&S EB500-HF)
- R&S EB500: SW extensions R&S UMS30-XX according to the following table:

| SW option for R&S EB500 if installed in R&S UMS300 | SW option for R&S EB500 as stand-alone unit acc. to R&S EB500 datasheet |
|--|---|
| UMS30-COR | EB500-COR |
| UMS30-DDC | EB500-DDC |
| UMS30-DF | EB500-DF |

| SW option for R&S EB500 if installed in R&S UMS300 | SW option for R&S EB500 as stand-alone unit acc. to R&S EB500 datasheet |
|--|---|
| UMS30-FE | EB500-FE |
| UMS30-IM | EB500-IM |
| UMS30-PS | EB500-PS |
| UMS30-SL | EB500-SL |
| UMS30-WDF | EB500-WDF |

1.7 Ordering Information

Please refer to the current product brochure or the latest data sheet for all ordering information. Information about additional accessories is available upon request.

2 Preparation for Use

2.1 Unpacking and Checking

Checking for transport damage

Before you examine the system, check the shipping box and the packing materials for damage. If you detect any damage, notify the shipping company immediately. Keep the box and the packing materials until you have confirmed that the delivery is complete, and until the R&S UMS300 has been checked electrically and mechanically.

Use the original packing materials for transportation or shipping of the R&S UMS300 at a later time. Rohde & Schwarz only accepts warranty claims if the equipment has been shipped in suitable packaging.

Unpacking

The system is delivered along with its specific accessories in a cardboard box. Any options that are ordered along with the R&S UMS300 are normally installed at the plant.

To unpack the box's content, proceed as follows:

1. Open the box, observing any notices that might be on the box.
2. Remove all parts and accessories from the packing materials.
3. Keep the packing materials on hand for transportation or shipping at a later time.

Checking the shipment for completeness

Check the shipment for completeness by comparing it with the packing list and delivery note. An overview of the equipment supplied is found in [chapter 1.6, "Equipment and Accessories Supplied"](#), on page 16.

2.2 Installation

2.2.1 Selecting the Location

When selecting the installation location, follow the recommendations in the ITU Spectrum Monitoring Handbook 2011 or the Rohde & Schwarz document "Infrastructure and Installation Guideline for Spectrum Monitoring Solutions of R&S" (available from your R&S sales representative).

Some important recommendations are as follows:

- Install the system (and especially the antennas) at a location that is as high as possible and without any obstructions in the direction of reception.
- Avoid locations that are close to transmitter sites such as broadcasting or mobile radio transmitters (intermodulation signals could cause interference in such cases).
- Avoid locations near metal objects.
- Make sure to maintain sufficient distance from live equipment such as high-voltage power lines.

2.2.2 Installation

The R&S UMS300 is designed for vertical installation on a mast or wall. Use the supplied clamps to install the system on a mast. Attach two of the clamps on the device by means of screws. Then use these clamps to hang the R&S UMS300 into the clamps previously installed on the mast. Securely attach the device to the mast by means of screws.

Prior to installation, ensure that the mast's diameter matches the mounting clamps. The R&S UMS300 must be securely attached.

Also ensure that the mast is sufficiently strong and can withstand significant wind load with the R&S UMS300 mounted on it.

For wall mounting an additional flange is required. This flange must be manufactured on site so that it can be customized depending on the local conditions.

Mounting on a mast

Attach the two holders to the R&S UMS300 by means of screws as shown in the figure.

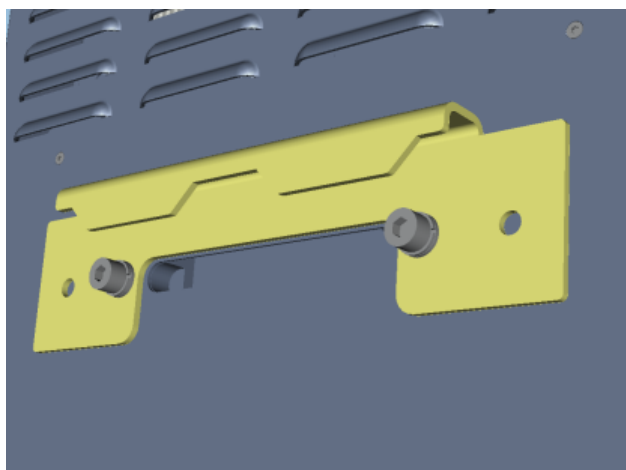


Fig. 2-1: Mounting on a mast 1

Attach the two mast holders to the mast at the correct distance from one another.

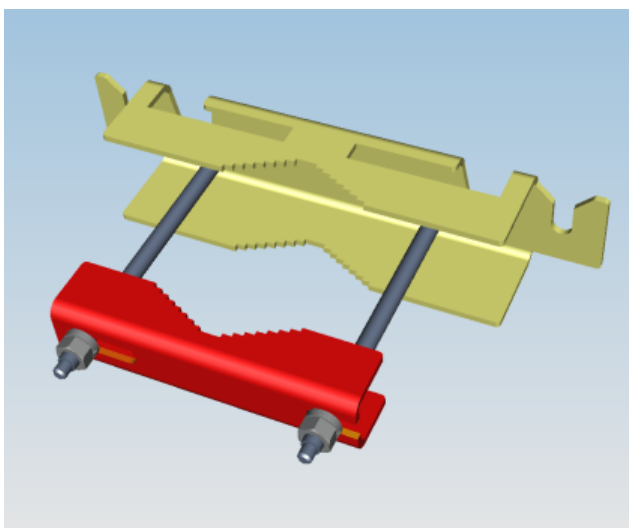


Fig. 2-2: Mounting on a mast 2

Hang the R&S UMS300 into the mast holders and attach them by means of the screws as shown in the figure.

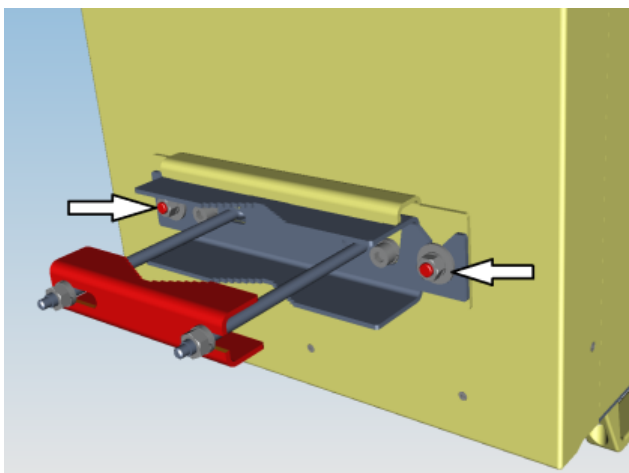


Fig. 2-3: Mounting on a mast 3

Mounting on a wall

The R&S UMS300 is also designed for wall mounting. For wall mounting suitable metal mounting flanges must be used. These flanges can be mounted horizontally or vertically on the housing and bolt-fastened to the tapped bores at the rear of the device.



When mounting the device on a wall make sure that there are at least 4 cm of free space between the rear of the device and the wall to ensure sufficient cooling of the R&S UMS300.

The mounting flanges are not included in the delivery and must be installed on site (for dimensions see [figure 2-4](#)).

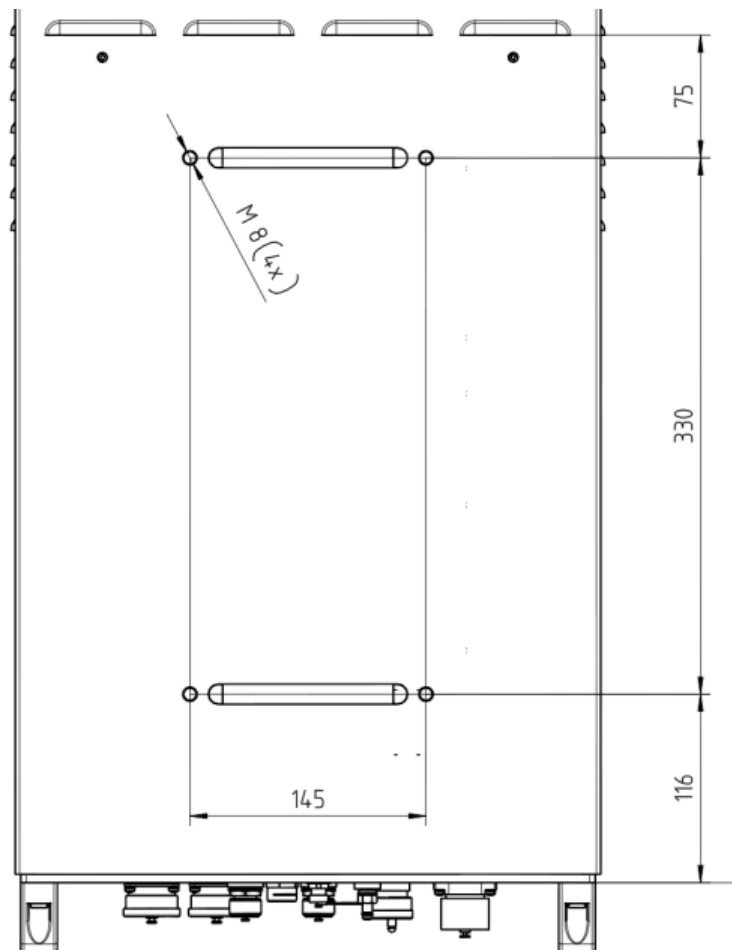


Fig. 2-4: Rear view: dimensions for mounting flange

2.3 System Overview

All of the R&S UMS300 connectors are arranged on the bottom of the system.

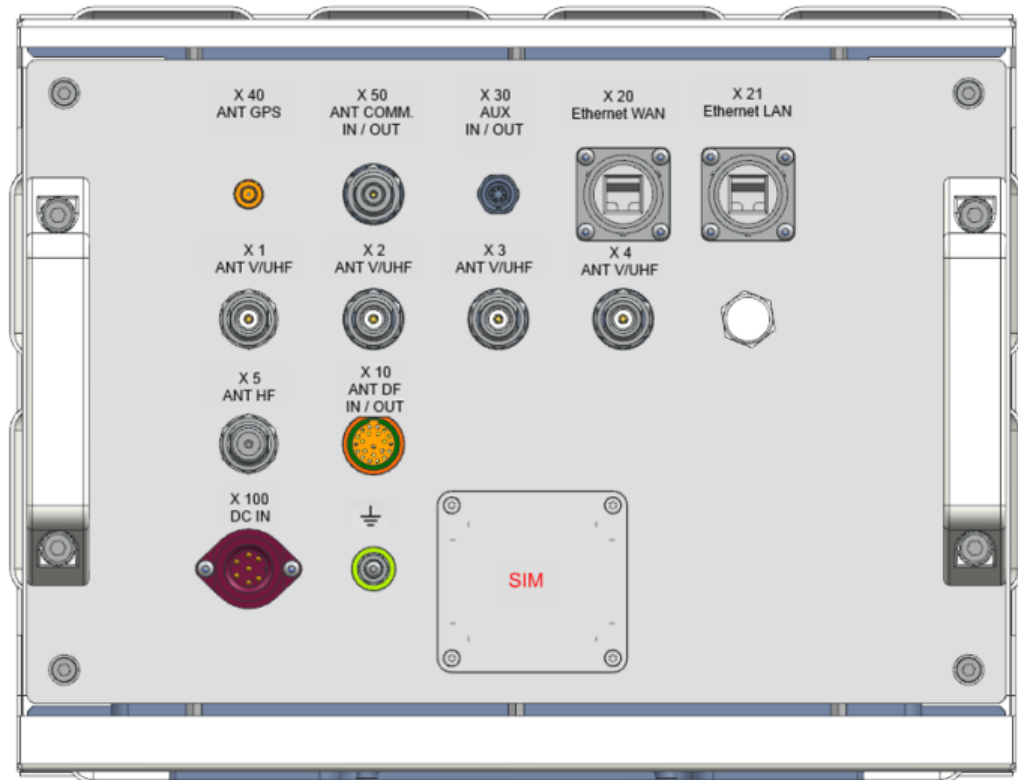


Fig. 2-5: Connection panel of the R&S UMS300

| Designation | Function |
|----------------------|--|
| X1 ANT V/UHF | N female V/UHF antenna input 1 This connector can be equipped with a DC feed for active antennas. In this case, it is designated with the ⚠ icon. |
| X2 ANT V/UHF | N female V/UHF antenna input 2 This connector can be equipped with a DC feed for active antennas. In this case, it is designated with the ⚠ icon. |
| X3 ANT V/UHF | N female V/UHF antenna input 3 |
| X4 ANT V/UHF | N female V/UHF antenna input 4 |
| X5 ANT HF | N female input HF antenna |
| X10 ANT DF IN/OUT | Connector for control cable, DF antenna |
| X20 Ethernet-WAN | WAN port (remote control via ADSL, Ethernet, etc.) |
| X21 Ethernet-LAN | LAN port (coupled with internal LAN switch for system computer and receiver) |
| X30 AUX IN/OUT | Allows connection of three alarm inputs and a PT100 temperature sensor alternative: project-specific service connection to internal router |
| X40 ANT GPS | GPS antenna connector |
| X50 ANT COMM. IN/OUT | 3/4G antenna connector (UMTS, HSPA, LTE) |

| Designation | Function |
|-------------|---|
| X100 DC IN | DC voltage supply connector |
| SIM | Cover for SIM card holder (for mobile communications) |

2.4 Cabling and Connection of External Components

2.4.1 Grounding

NOTICE

Grounding

The system must be properly grounded before it is put into operation. Be sure to heed the local regulations.

On the bottom of the R&S UMS300, there is a grounding bolt indicated by \perp that is used to provide a protective earth connection for the system. The grounding cable's cross-section should be at least 1.5 mm².

2.4.2 Power Supply

The R&S UMS300 is designed for operation on a DC voltage (22 V DC to 26 V DC). A suitable power cable with bare leads on one end is supplied with the system.

For AC operation of the device (110 V AC to 230 V AC) an appropriate power supply unit is available as an accessory (see [chapter 1.6.3, "Recommended Accessories/Options"](#), on page 16).

CAUTION

Make sure power supply is steady and reliable to prevent the device from being powered down in an uncontrolled manner, since this may damage the device. Use an uninterruptible power supply (UPS), if necessary.



For AC operation use a power supply unit of the type Mean Well HLG-320-H-24 (included in option R&S UMS30-H1) to ensure CE compliance of the R&S UMS300.

The supplied cable for feeding the system with a DC voltage is connected to the X100 DC IN connector.



Whenever possible, use the supplied connection cables to connect the system. These cables are suitable for outdoor use. If necessary, replace them with cables of the same quality (cross section, UV resistance, shielding). Lay the cables neatly and without any bends.

2.4.3 Ethernet-LAN Interface (X21 LAN)

The R&S UMS300 is equipped with two Gigabit Ethernet RJ-45 interfaces. Use standard LAN patch cable (category 6e or better) and the supplied RJ-45 connector housing to connect the system to a LAN switch.

The LAN port X21 is used for maintenance purposes or for connection of additional system devices (e.g. R&S FU129 Antenna Selector Switch). Ex works the LAN port X21 is protected against unauthorized access, only the SSH protocol is allowed. Before you can use the port, the firewall rules applied for its protection must be deactivated or changed.

The LAN port X21 has the IP address 192.168.0.1/24.

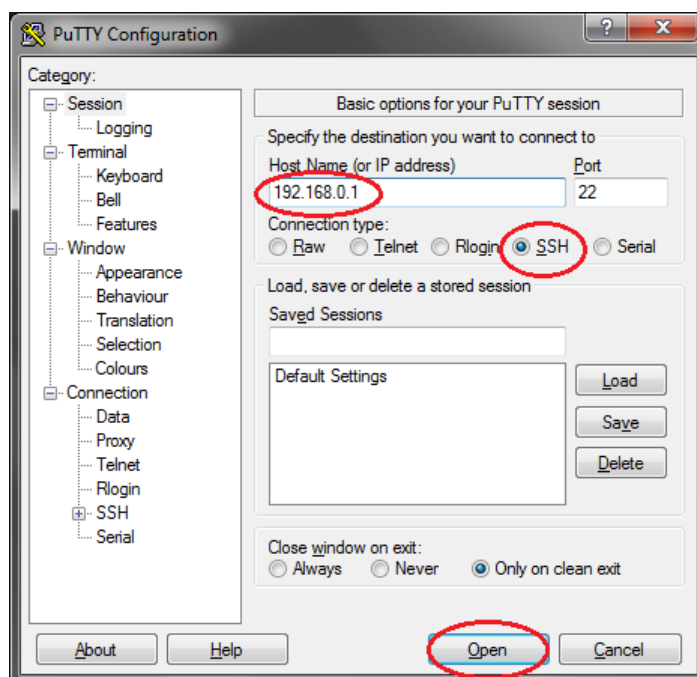
Two scripts are running on the router that are used to deactivate and reactivate the firewall rules. To activate or deactivate the rules proceed as follows:

Enabling the LAN port for maintenance or operation of an additional system device (R&S FU129)

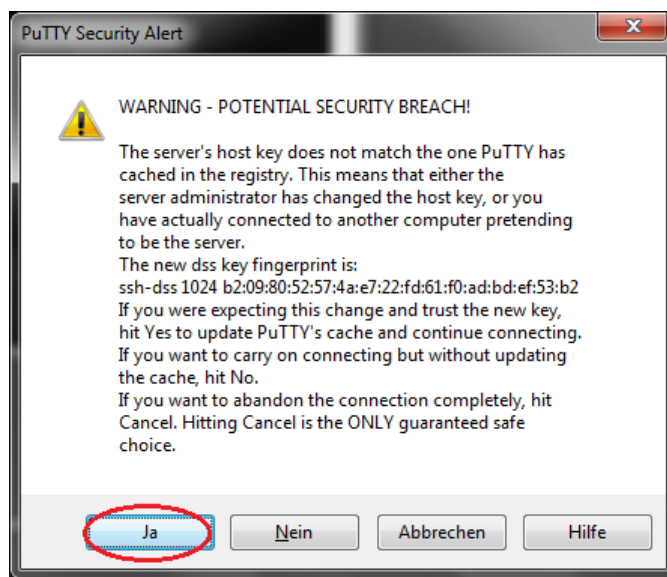


For this you need an SSH client (e.g. `putty.exe`, which is available free of charge) on your PC.

1. Connect an external PC to the LAN port X21 and assign it an IP address in the subnet 192.168.0.0 (e.g. 192.168.0.2/24). On the external PC enter the router address 192.168.0.1 as the default gateway.
After deactivating the firewall you can access the system computer using the address 10.0.1.10.
2. Open an SSH connection to the router (IP address 192.168.0.1) and log in to the router (user: "admin", password "radmon").
The following screenshots show how the router is accessed using `putty.exe`.
3. Start `putty.exe` and under "Host Name (or IP Address)" enter the IP address of LAN port X21 (192.168.0.1). Make sure the SSH protocol is enabled and click "Open".



- If you connect to the R&S UMS300 the very first time, confirm the message relating to an unknown key with "Yes".



- At the login prompt log in as user *admin* and confirm the entry. Enter the password *radmon*.



The router answers with the following screen.

```

192.168.1.1 - PuTTY

MMMM  MMMM      KKK                      TTTTTTTTTT      KKK
MMM MMMM MMM III KKK KKK RRRRRR      OOOOOO      TTT III KKK KKK
MMM MM  MMM III KKKKK RRR RRR  OOO OOO      TTT III KKKKK
MMM      MMM III KKK KKK RRRRRR      OOO OOO      TTT III KKK KKK
MMM      MMM III KKK KKK RRR RRR  OOOOOO      TTT III KKK KKK

MikroTik RouterOS 6.7 (c) 1999-2013      http://www.mikrotik.com/

[?]          Gives the list of available commands
command [?]  Gives help on the command and list of arguments

[Tab]       Completes the command/word. If the input is ambiguous,
            a second [Tab] gives possible options

/           Move up to base level
..         Move up one level
/command    Use command at the base level

[admin@ums300-rt] >

```

6. Execute the command `system script run Disable-FW-ether3` to deactivate the firewall rules and enable X21 for all data traffic.
7. The command `system script run Enable-FW-ether3` reactivates the protection.



Do not forget to reactivate the LAN port protection when the port is no longer used for connection of system devices.

2.4.4 Ethernet-WAN Interface (X20 WAN) and Setup of a Router for the Control Center

The Gigabit Ethernet interface X20 is used for connection to a line-bound transport network which provides access to the control center. This makes it possible to remotely manage the R&S UMS300 from the control center and transmit measurement results back to the control center.

Depending on the actual requirements and local circumstances, this can be an Ethernet network or in some cases a DSL connection. Ex works the Ethernet-WAN port X20 is set up to receive IP addresses via DHCP.

In this case as well, use one of the supplied RJ-45 connector housings.



Use LAN cables of category CAT6 SFTP or better to ensure CE compliance of the R&S UMS300.



By default, the port X20 of R&S UMS300 obtains its IP address via DHCP (Dynamic Host Configuration Protocol). Alternative ways of access (e.g. via ADSL) must be configured specifically.

Setup of a router for the control center

For operating the R&S UMS300 in a TDoA sensor network or spectrum monitoring network the control center must be provided with an appropriately configured router. The following describes how to configure such a router.

The hardware required for this configuration comprises a MikroTIK router with at least five Gigabit Ethernet connectors.

Select a MikroTIK device that is able to support the number of sensors available with your R&S UMS300.

1. To customize the configuration detailed below for your specific application change the ADSL user name and password as well as the IPsec and PPP passwords (all in <>). Use Windows "Notepad" to do so ("Wordpad" inserts unwanted control characters). Changes are required in the following sections:

```
/interface pppoe-client  
/ip ipsec peer  
/ppp secret
```
2. Connect an external PC to the "Ethernet 2" interface using a LAN switch or crossover cable (with MikroTIK devices straight from the plant, port 1 is not yet set up for access via "Winbox"). In this configuration, "Ethernet2" is set up as LAN port, "Ethernet1" as ADSL access and "Ethernet5" as WAN port.
3. Start `Winbox.exe` and connect to the router as described in [chapter 4.3.1, "Winbox"](#), on page 51.
4. Reset the existing configuration of the router as described in [chapter 4.3.4, "Resetting and Loading a Configuration"](#), on page 55.
5. After the router has restarted reconnect to it using "Winbox", open a new terminal window and copy and paste the first part of the configuration given below into the terminal window. Winbox will lose the connection to the router.
6. Reconnect to the router and copy and paste the second part of the configuration.
The central router is now ready to communicate with the R&S UMS300 sensors.

It can be connected via the WAN port "Ethernet5" to the Ethernet that it shares with the sensors. The DHCP server will assign IP addresses to the sensors, which can be reached from the control center via these addresses.

If the sensors are connected via a mobile communications network, they will connect to the control center via the ADSL access on port "Ethernet1". However, this requires that the public IP address of the ADSL access point is static, i.e. always the same, and that this address has been entered in the router configuration the R&S UMS300 devices.

Typically, for a particular project a configuration file for the R&S UMS300 will be created that contains all required data (IP address of the central computer, project-specific passwords etc.), and this file will be loaded on the devices prior to installation. All R&S UMS300 devices of a sensor network share the same configuration file, thus there is no need to configure them individually.



Via the connector X20 Ethernet-WAN only particular protocols and applications are routed to the system computer of the R&S UMS300: All applications required for operation in an R&S Argus sensor network as well as e.g. Windows Remote Desktop or some applications required for maintenance purposes.

Configuration

The configuration given below can be used for the central router in a productive system, provided that the passwords and (ADSL) user names are modified accordingly.

It covers all three scenarios illustrated in [chapter 1.4, "R&S UMS300 as Part of a Sensor Network"](#), on page 12.

The configuration was tested for MikroTIK RouterOS version 6.7.



The passwords and (ADSL) user names in the configuration given below are project-specific and must be changed to reflect the current application.

The <user names> and <passwords> used in this configuration are mere place holders.

Part 1

```
/interface l2tp-server
add name=l2tp-SRV user=demo
add name=ums300-1 user=ums300-1
add name=ums300-2 user=ums300-2

/interface ethernet
set [ find default-name=ether1 ] name=ether1-DSL
set [ find default-name=ether2 ] name=ether2-LAN
set [ find default-name=ether3 ] master-port=ether2-LAN
set [ find default-name=ether4 ] master-port=ether2-LAN
set [ find default-name=ether5 ] name=ether5-WAN
```

Part 2

```
/interface pppoe-client
add add-default-route=yes disabled=no interface=ether1-DSL name=\
  pppoe-out1-ADSL password=<ADSL_password> use-peer-dns=yes user=\
  <ADSL-Benutzer>

/ip ipsec proposal
set [ find default=yes ] enc-algorithms=aes-256-cbc
```

Cabling and Connection of External Components

```
/ip pool
add name=l2tp-pool ranges=172.16.1.2-172.16.1.100
add name=dhcp_pool2 ranges=172.20.206.2-172.20.206.100

/ip dhcp-server
add add-arp=yes address-pool=dhcp_pool2 disabled=no interface=ether5-WAN \
    name=dhcp1 src-address=172.20.206.1

/ppp profile
add local-address=172.16.1.1 name=l2tp remote-address=l2tp-pool \
    use-mpls=no

/interface l2tp-server server
set enabled=yes max-mru=1460 max-mtu=1460

/ip address
add address=192.168.1.1/24 interface=ether2-LAN network=192.168.1.0
add address=172.20.206.1/16 interface=ether5-WAN network=172.20.0.0

/ip dhcp-server network
add address=172.20.0.0/16 gateway=172.20.206.1

/ip ipsec peer
add enc-algorithm=aes-256 exchange-mode=main-l2tp generate-policy=\
    port-override secret=<IPSec Secret> send-initial-contact=no

/ppp secret
add local-address=172.16.1.1 name=demo password=<PPP_password> profile=l2tp \
    service=l2tp
add local-address=172.16.1.1 name=ums300-1 password=<PPP_password> profile=\
    default-encryption remote-address=172.16.1.101 service=l2tp
add local-address=172.16.1.1 name=ums300-2 password=<PPP_password> profile=\
    default-encryption remote-address=172.16.1.102 service=l2tp

/routing rip interface
add interface=ether2-LAN send=v1-2
add interface=ether5-WAN send=v1-2

/routing rip network
add network=172.20.0.0/16
add network=192.168.1.0/24

/system identity
set name=hq-rt

/ip firewall filter
add chain=input in-interface=ether5-WAN protocol=ipsec-esp
add chain=input dst-port=500,4500 in-interface=ether5-WAN protocol=udp
add chain=input protocol=udp src-port=1701
add chain=input protocol=icmp
```

```
add chain=input connection-state=related in-interface=ether1-DSL
add chain=input connection-state=established in-interface=ether1-DSL
add action=drop chain=input in-interface=ether1-DSL
add action=drop chain=input in-interface=ether5-WAN
add chain=input connection-state=established connection-type="" in-interface=\
    pppoe-out1-ADSL
add chain=input connection-state=related in-interface=pppoe-out1-ADSL
add action=drop chain=input in-interface=pppoe-out1-ADSL
```

2.4.5 Assembly of the RJ-45 Connector Housing

In order to ensure sufficient protection against bad weather, the supplied connector housing must be used.

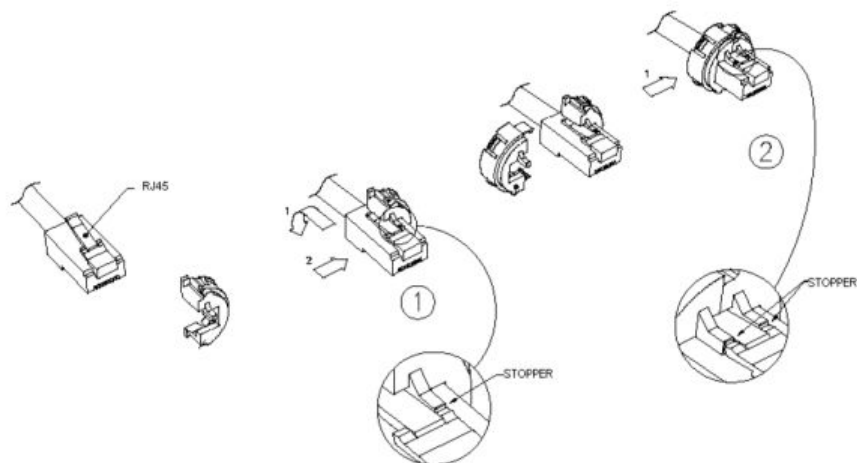


Fig. 2-6: Assembling the RJ-45 connector housing – inside portion

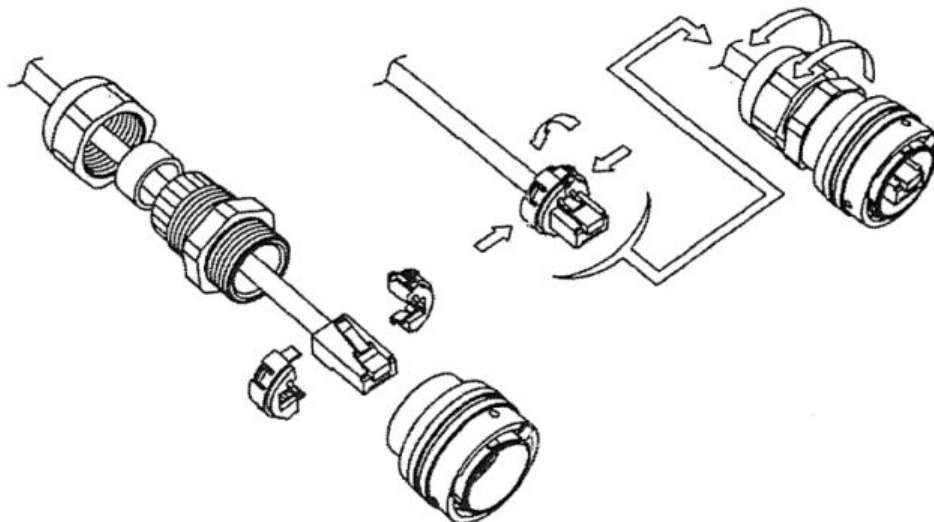


Fig. 2-7: Assembling the RJ-45 connector housing – outside portion



Fig. 2-8: RJ-45 connector in housing as required by Code C

2.4.6 Antennas

Since no antennas are included with the R&S UMS300, they must be purchased separately as an accessory. For example, Rohde & Schwarz offers antennas for the ranges from 20 MHz to 1.3 GHz and 1.3 GHz to 6 GHz which are suitable for use with the R&S UMS300. However, it is also possible to use any other R&S antenna that suits the frequency range of the R&S UMS300.

The R&S ADD075 is used as a direction finding (DF) antenna.

Connect the antennas using suitable low-loss cables with N male connectors to the female connectors provided on the R&S UMS300 (X1 to X5).

Connect the control cable for the direction finder to connector X10.



Be aware that active antennas require a voltage supply (DC feed on X1 or X2).



Use double shielded RF cables to ensure CE compliance of the R&S UMS300.

2.4.7 DC Feed for Active Antennas

If active antennas are to be used with the R&S UMS300, the system must be equipped with appropriate DC feeds. Up to two DC feeds can be installed (always on X1 and X2). Connectors that have a voltage present on them are indicated with the ⚠ icon.

The configuration of the system with DC feeds must be defined when the system is ordered.

2.4.8 Antenna Selection Switch

The base unit of the R&S UMS300 does not include an antenna selection switch. If necessary, an antenna selection switch must be ordered with the system. The switch is then installed at the plant.

In the basic configuration, the receiver's antenna input is on X1 ANT V/UHF on the connection panel of the R&S UMS300.

A 1-out-of-2 switch and a 1-out-of-4 switch are available as accessories. A maximum of four antennas can be connected. For possible switch configurations see [chapter 1.3.8, "Antenna Selection Switch \(Optional\)"](#), on page 12.

Prior to connecting the antennas, make sure you are familiar with the configuration of your R&S UMS300.

The antenna switch is operated by the R&S Argus system software.

2.4.9 Fast Electronic Antenna Switch

This switch allows the receiver to use different antennas during a fast scan over a wide frequency range. Here, the receiver uses TTL to switch the currently required antenna to the receiver input.

If you ordered your R&S UMS300 with a fast antenna switch, it was connected to the appropriate receiver output at the plant.

For details on the receiver configuration to control the fast switch refer to the R&S EB500 manual.

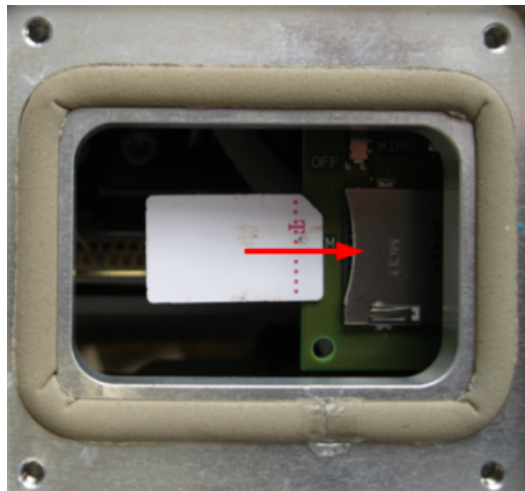
2.4.10 Inserting a SIM Card for Connection via a Mobile Communications Network

To connect an R&S UMS300 via a mobile communications network (also see scenario 3 described in [chapter 1.4, "R&S UMS300 as Part of a Sensor Network"](#), on page 12) a 3/4G enabled SIM card from a local network provider is necessary.

1. Unscrew the cover of the SIM card holder on the connection panel.



2. Insert the SIM card into the holder in the position shown in the figure and push it fully in against a slight resistance. The card snaps into place. If it does not snap it, it won't be properly seated.



3. Reinsert the cover and screw it down.

To remove the card press down its rear edge. The card disengages and can be withdrawn from the card holder.



To be able to connect the R&S UMS300 via a mobile communications network to a control center, an Internet access with a static public IP address is necessary in the center. This address must be entered in the router configuration on the R&S UMS300.

The router is configured by means of scripts. Changes to the tunnel and firewall settings made via the `Winbox.exe` interface (see [chapter 4.3, "Router"](#), on page 51) will be overwritten at regular intervals; therefore the scripts have to be edited to achieve permanent changes.

The configuration of the R&S UMS300 router and of an appropriate central router is dealt with in a separate document. To request this document please contact your R&S sales representative.

2.4.11 Specifications of the Mobile Communications Antenna

To ensure CE compliance of the R&S UMS300 the mobile communications antenna at X50 ANT COMM. IN/OUT must meet the following specifications:

| Parameter | Requirement | Remarks |
|---------------------------|--|---|
| Antenna system | External multiband antenna | |
| Frequency bands | 700 MHz to 960 MHz 1710 MHz to 1990 MHz 2110 MHz to 2170 MHz 2500 MHz to 2700 MHz | |
| VSWR | 1:1 (ideal) < 2.5:1 (recommended) | In all frequency bands including band limits |
| Total radiated efficiency | > 50 % in all frequency bands | Measured at RF connector Includes mismatch losses, losses in the matching circuit, and antenna losses, excluding cable loss. |
| Radiation pattern | Nominal: Nominally omni-directional radiation pattern in azimuth plane | |
| Mean effective gain | > -3 dBi | |
| Power handling | > 2 W RF power in lower frequency bands > 1 W in upper frequency bands | |

3 Operation

3.1 Introduction

The R&S UMS300 has no man-machine interface (MMI) of its own. In productive operation, the system is operated exclusively by the R&S Argus system software. A computer with an R&S Argus control unit is required for this purpose.

This control unit can be connected via Ethernet to the local area network (LAN) of the R&S UMS300 (connector X21), or the R&S Argus control unit can be located at a remote site (control center) and access the R&S UMS300 solely via an intermediary transport network. In this case, the wide area network (WAN, connector X20) must be used. This connector provides a routed connection to the LAN of the R&S UMS300. Ex works the IP address of the WAN port is assigned by DHCP.

If necessary, this router port can also be configured for connection of a DSL modem or for use with a static IP address.

3.2 Switching the System On

⚠ CAUTION

Before switching the system on, ensure that the following conditions are met:

- The screws on the system as well as on the add-ons are fastened tightly.
- The system is properly grounded in accordance with regulations.
- The signal levels at the inputs (ANTENNAS, ETHERNET and GPS) are within the prescribed limits.
- The supplied AC and/or DC operating voltages are within the permitted range.

Any non-compliance with these requirements may endanger people and/or cause damage to the equipment.

The R&S UMS300 does not have a power-on button. The system will start up automatically as soon as the supply voltage is connected to X100 DC IN.

After it is switched on, the system runs through a series of test sequences. In the process, the system determines if the prerequisites are met for reliable operation with regard to the temperature and voltages. If, for instance, the temperature is too low, the heating is first activated before the system components are switched on. The inside components are not started until the operating temperature is reached.

As a result, it can take a few minutes until the R&S UMS300 has completely started up and is ready for operation.

3.3 Local Operation

During local operation, the R&S UMS300 is controlled using an R&S Argus control unit in the IP subnet of the LAN port. The control unit must be connected to the system's LAN port (X21 Ethernet-LAN) and have an IP address in the subnet 192.168.29.0 /24. In [figure 3-1](#) the R&S Argus control unit has the address 192.168.0.10.



If multiple R&S UMS300 systems are to be connected to a control center, the WAN port (X20 Ethernet-WAN) of the R&S UMS300 must be used. Here, the IP address of the WAN port must be unique (different) for each and every system, which is achieved by the use of DHCP.

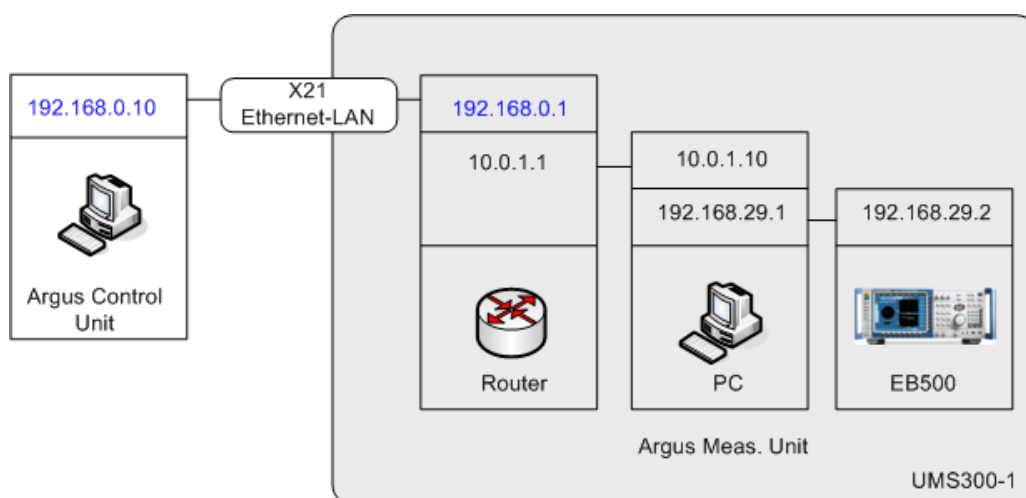


Fig. 3-1: Local operation of the R&S UMS300



Ex works, firewall rules are applied to protect the LAN port X21 against unauthorized access. Only the SSH (Secure Shell) protocol is allowed.

Before the R&S UMS300 can be used as described above, these rules must be deactivated.

For instructions refer to "[Enabling the LAN port for maintenance or operation of an additional system device \(R&S FU129\)](#)" on page 24.

3.4 Remote Operation

Remote operation means the R&S Argus control unit is not connected directly to the R&S UMS300. Instead, it is connected via an intermediary transport network (see also [figure 3-2](#)).

This transport network can be a private Ethernet network or also a provider network (DSL, VPN, etc.).

In this case, the R&S UMS300 must be connected to the transport network via the X20 connector (Ethernet-WAN).

In the factory default state, the WAN port is configured with a DHCP client, i. e. for address allocation a DHCP server in the transport network is required. Using the "Winbox" tool installed on the system computer or a separate script, it is possible to set a static IP address (or configure the WAN port for connection to a DSL network) (see [chapter 4.3.1, "Winbox"](#), on page 51).

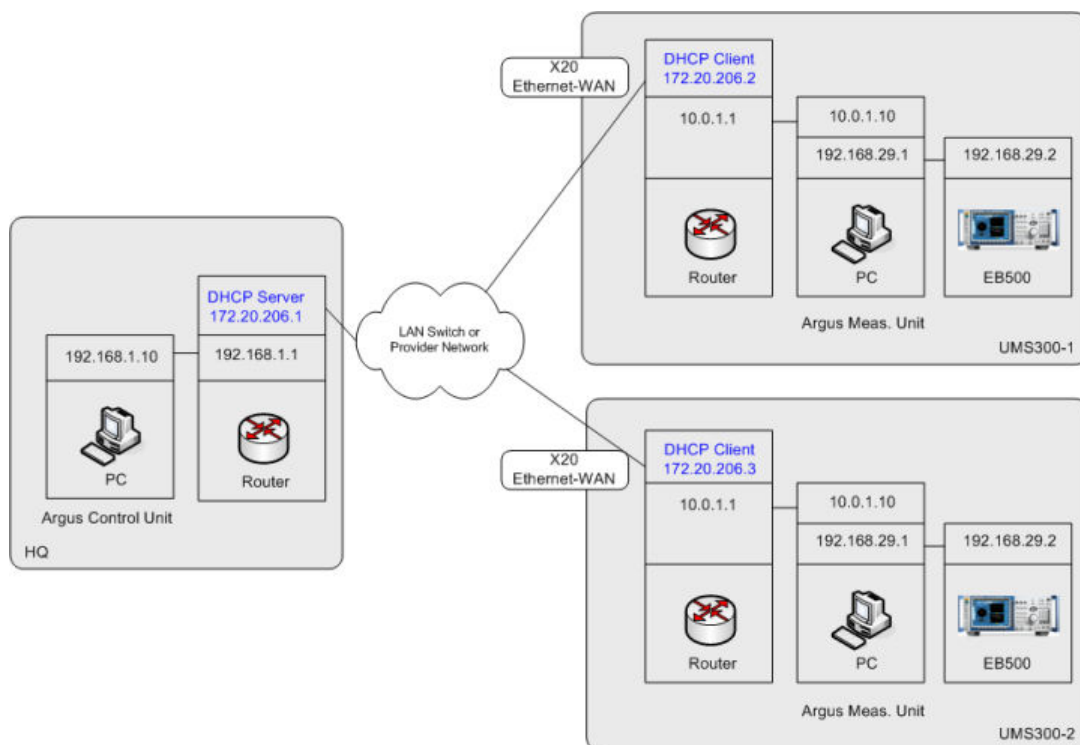


Fig. 3-2: Remote operation of the R&S UMS300

During remote operation, the routers in the R&S UMS300 systems manage the connection via the transport network.

In the example shown here, the WAN port of the router in the control center has the IP address 172.20.206.1, R&S UMS300 no. 1 has the address 172.20.206.2 allocated via DHCP and R&S UMS300 no. 2 has the address 172.20.206.3 also received via DHCP.

On the routers in the R&S UMS300 systems, the network address translation (NAT) protocol works with port forwarding to ensure that the R&S Argus control unit in the control center can always communicate with the desired target despite identical IP addresses in the systems.

3.5 Access to the System Computer via Windows Remote Desktop (RDP)

For reasons of security, the router does not forward the Remote Desktop Protocol (RDP). However, having remote access to the system computer may prove helpful in practical use. For this purpose, RDP can be deactivated/activated on the router using a script.

To activate the RDP execute the "Enable-RDP" script. The "Disable-RDP" script deactivates the protocol.

Execute the script as follows:

1. Connect to the router as described in [chapter 4.3.1, "Winbox"](#), on page 51.
2. Open "System" – "Scripts" and select the script ("Enable-RDP" or "Disable-RDP"), as required.
3. Click the "Run Script" button.

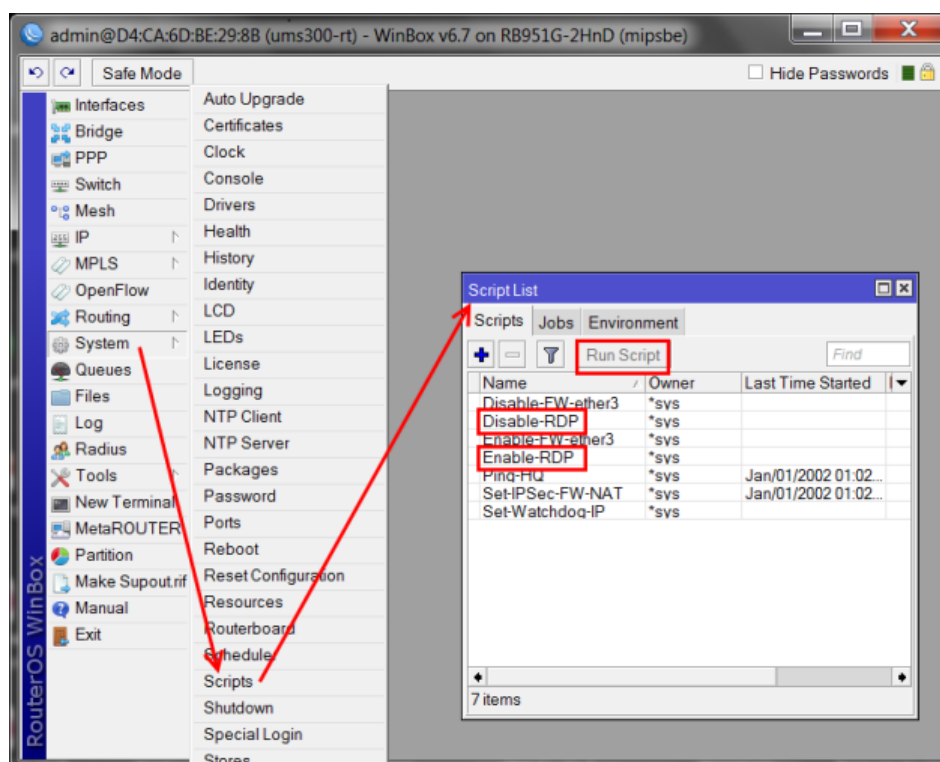


Fig. 3-3: Executing RDP scripts

3.6 Spectrum Monitoring Software R&S Argus

For operation of the R&S UMS300 the R&S Argus system software is recommended.

R&S Argus for the R&S UMS300 is available in two versions: The basic version (R&S UMS30-SWB) allows operation of the base unit; the extension (R&S UMS30-SWE) is necessary in order to use additional options such as the direction finder etc. (see [chapter 1.6.3, "Recommended Accessories/Options"](#), on page 16).

R&S Argus controls the R&S UMS300 via the Ethernet interfaces or the optional 3/4G wireless module. Measurement tasks can be directly executed by the operators at the control center via remote control of the R&S UMS300. Alternatively, it is possible to configure tasks which are then executed automatically at the desired time. The stored measurement results are available afterwards for further processing.

Further information on the R&S Argus and on installation and configuration of the software can be found in the data sheets and technical documentation on the product and in the manuals for the R&S Argus. In case of any other questions, contact the support center for the R&S UMS product line.

3.7 Operation via SCPI Commands

Both the receiver and the mainboard of the R&S UMS300 can be controlled and queried via SCPI commands.

For details on receiver operation refer to the R&S EB500 manual. Chapter 4 Remote Control via LAN Interface provides detailed information on how to control the device via SCPI commands and perform a diagnose on individual components.

Instructions for setting up the connection to the receiver for control via SCPI commands can be found in [chapter 4.4.4, "Checking the Receiver"](#), on page 59.

3.7.1 SCPI Commands

The R&S UMS300 can be controlled using SCPI commands (SCPI = Standard Commands for Programmable Instruments). This section contains a very brief introduction to SCPI commands followed by a listing of the commands available on the R&S UMS300.

In order to directly execute commands on the R&S UMS300, special software is required (e.g. National Instruments Measurement & Automation Explorer). Alternatively, Telnet can be used to connect to the receiver or mainboard and to execute SCPI commands (see [chapter 4.4.1, "Checking the Internal Operating Voltages"](#), on page 56).

SCPI in brief

For a more detailed introduction to SCPI refer to the manual for the R&S EB500 Monitoring Receiver, chapter 4.

SCPI commands consist of a "header" (the actual command) and one or more parameters. The header and parameter(s) are separated by a space ("white space").

Headers can consist of commands at different levels (hierarchies); in this case, they are separated by a colon (e.g. `SYST:ERR:LIST`).

The command keywords can be written in short form or long form: `SYSTEM:ERROR:LIST` or `SYST:ERR:LIST`. Other notations are not allowed.

SCPI commands can be used to query or set values. In case of a query, a question mark is required immediately after the command: `SYST:ERR:LIST?`

In order to set a value, it is written as a parameter after the header: `SWITCh:PATH:SET RD127 3` (path 3 of the selector "RD127" is activated).

3.7.2 SCPI Commands of the R&S UMS300

3.7.2.1 SYSTem Subsystem

This subsystem consists of commands for general functions.

| Command | Command parameter | Query/response | Description |
|---------------------------------|-------------------|----------------|------------------------|
| <code>SYSTem:ERRor?</code> | | <string> | Read last error status |
| <code>SYSTem:ERRor:LIST?</code> | | <string list> | Output list of errors |

Examples

Query: `SYST:ERR?`

Response: "0, No error"

Query: `SYST:ERR:LIST?`

Response: "8/27/2013 13:43|1:n Switch Group #0 ANTENNA used|Info,8/27/2013 13:44|No valid IP adapter found.|Error,8/27/2013 13:44|System successfully started.|Info,8/27/2013 13:46|1:n Switch Group #0 ANTENNA used|Info,8/27/2013 13:46|No valid IP adapter found.|Error,8/27/2013 13:46|System successfully started.|Info"

3.7.2.2 DIAGnostic Subsystem

The DIAGnostic subsystem contains commands that provide diagnostic support during service, maintenance and repair. In line with the SCPI standard, these commands are all device-specific.

| Command | Command parameter | Query/response | Description |
|---|-------------------|----------------|--------------------------|
| <code>DIAGnostic:SERvice:SFUNction</code> | <string> | | Execute service function |
| <code>DIAGnostic:SERvice:PASSword</code> | <string> | | Enter password |

| Command | Command parameter | Query/response | Description |
|----------------------------------|-------------------|----------------|-------------------------------------|
| DIAGnostic:SERvice:SWInfo? | | <string list> | List of installed software versions |
| DIAGnostic:SERvice:HWInfo? | | <string list> | List of hardware |
| DIAGnostic:SERvice:STEST | | | Start self-test |
| DIAGnostic:SERvice:STEST:RESult? | | <string list> | Display result of self-test |

Examples

Command: DIAG:SERV:PASS "30473035"

Query: DIAG:SERV:SWIN?

Response: "UMS300|0.94|0.94|0,Compass|3.0.15.3|3.0.15.3|---,Motherboard |C|0.60|0.60|---"

Query: DIAG:SERV:HWIN?

Response: "UMS300|UMS300|999999/999|3051.7701|99|99|999|1980-01-01,BASE|UMS300|999999/999|3051.7701|99|99|999|1980-01-01"

Command: DIAG:SERV:STES;*OPC?

Query: DIAG:SERV:STES:RES?

"Voltage|||,Actual Current Peltier |0.20 A||Passed,Actual Current EB500 |1.36 A |Passed,Actual Voltage for 5 V |5.13 V||Passed,Actual Voltage for 3.3 V |3.33 V |Passed,Actual Voltage for VIN |23.89 V||Passed,Actual Voltage for 24 V |23.86 ||Passed,|||,Temperature|||,Actual Temperature UMS300|35 |C||Passed,Actual Temperature Extern|-|-,|||,Peltier|||,Peltier Cooling|OFF||Passed,Peltier Heating|O F||Passed,|||,Alarms|||,Extern Alarm 1|OK||Passed,Extern Alarm 2|OK||Passed,Ext rn Alarm 3|OK||Passed,Peltier Alarm 1|OK||Passed,|||,Overall Result|||Passed"

3.7.2.3 SWITCh Subsystem

The SWITCh subsystem contains commands for setting the paths and switches.

| Command | Command parameter | Query/response | Description |
|------------------|--|----------------|--|
| SWITCh? | | <string list> | Query string list of available switch groups |
| SWITCh:PATH? | <string numeric> | <string list> | Display available paths (string list) for a switch |
| SWITCh:PATH:SET | <string numeric> <string numeric> (switch, path) | | Set active path for the specified switch |
| SWITCh:PATH:SET? | <string numeric> (switch) | <string> | Read active path for the specified switch |

Examples

Query: SWIT?

Response: "ANTENNA"

Query: SWIT:PATH? "ANTENNA" or SWIT:PATH? "0"

Response: "ANT1,ANT2,ANT3,ANT4"

Command: SWIT:PATH:SET "ANTENNA", "ANT2" or SWIT:PATH:SET "0", "1"

Query: SWIT:PATH:SET? "ANTENNA" or SWIT:PATH:SET? "0"

Response: "ANT2"

4 Maintenance



Many of the procedures described in this chapter require the R&S UMS300 to be accessed from the outside via the Ethernet ports X20 (WAN) and X21 (LAN). Therefore familiarize yourself with the network concept and the characteristics of the Ethernet ports before embarking on any maintenance procedures. In particular read ["Enabling the LAN port for maintenance or operation of an additional system device \(R&S FU129\)"](#) on page 24 and [chapter 2.4.4, "Ethernet-WAN Interface \(X20 WAN\) and Setup of a Router for the Control Center"](#), on page 26 as well as [chapter 3.3, "Local Operation"](#), on page 36 and [chapter 3.4, "Remote Operation"](#), on page 36.

4.1 System Computer

The system computer of the R&S UMS300 does not have a user interface. There are two different ways of operating the system:

- From an external computer via a network connection using Windows Remote Desktop
- Connection of a keyboard, mouse and monitor. The system must be opened for this purpose (see [chapter 4.5, "Opening the R&S UMS300"](#), on page 64).

4.1.1 Access via Windows Remote Desktop

Different settings are required on your external PC depending on whether you intend to establish a Remote Desktop connection via the WAN port (X20) or the LAN interface (X21) of the R&S UMS300.

Details on the network concept can be found in [chapter 3.3, "Local Operation"](#), on page 36 and [chapter 3.4, "Remote Operation"](#), on page 36.

4.1.1.1 Local Access via X21

First of all deactivate the firewall for this port. For instructions see ["Enabling the LAN port for maintenance or operation of an additional system device \(R&S FU129\)"](#) on page 24.

If you connect an external PC to the LAN port (X21) as described in [chapter 3.3, "Local Operation"](#), on page 36, assign it an IP address in the subnet 192.168.0.0 /24 (e.g. 192.168.0.3) and enter 192.168.0.1 as default gateway, you can connect to the address 10.0.1.10 of the system computer using Windows Remote Desktop.

4.1.1.2 Remote Access via X20

If you wish, for example, to access the system computer from the control center, you must use Remote Desktop to connect to the router's **WAN address** that was assigned by DHCP. The router forwards the remote desktop session to the system computer. Also see [chapter 4.4.6, "Setting Up Access via X20 Ethernet-WAN"](#), on page 61.



In the factory default state the Remote Desktop Protocol (RDP) is deactivated. Before you can access the system computer via RDP you have to activate it as described in [chapter 3.5, "Access to the System Computer via Windows Remote Desktop \(RDP\)"](#), on page 38.

The IP address of the R&S UMS300 can be found on the central router. Use "Winbox" to connect to the central router (see [chapter 4.3.1, "Winbox"](#), on page 51) and in the "IP" menu select the "DHCP Server" option. Activate the "Leases" tab. Under "Active Addresses" all assigned IP addresses are listed.

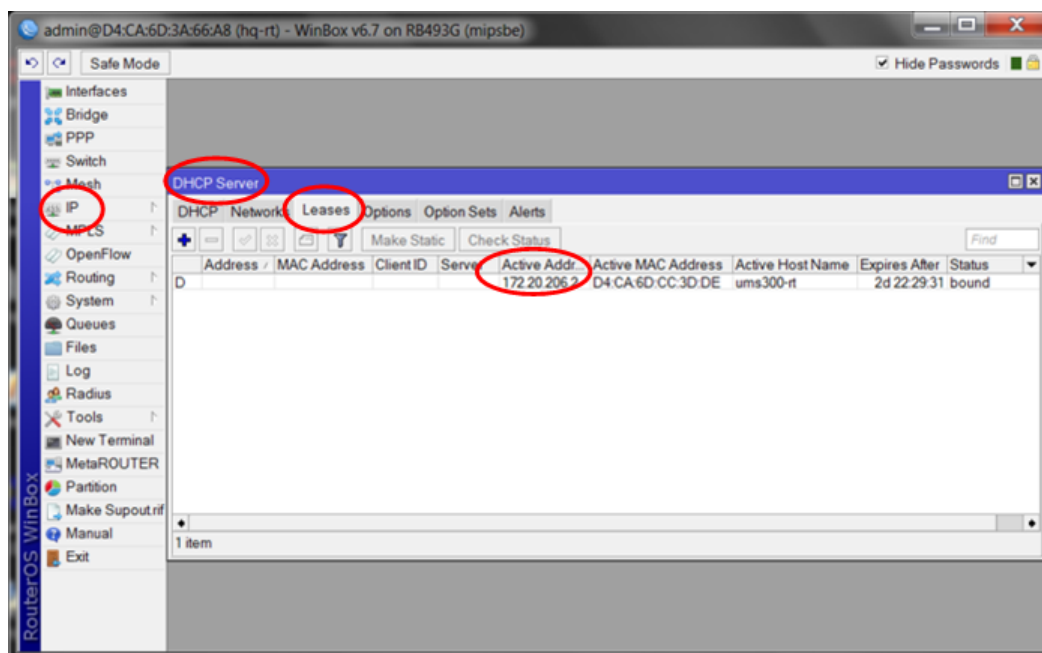


Fig. 4-1: DHCP Server - Leases

4.1.2 Connecting the Keyboard, Mouse and Monitor

In order to access the connectors for the keyboard and mouse (USB) as well as for the monitor (VGA), it is necessary to open the housing of the R&S UMS300.

These connectors are located next to the power supply and system computer boards.

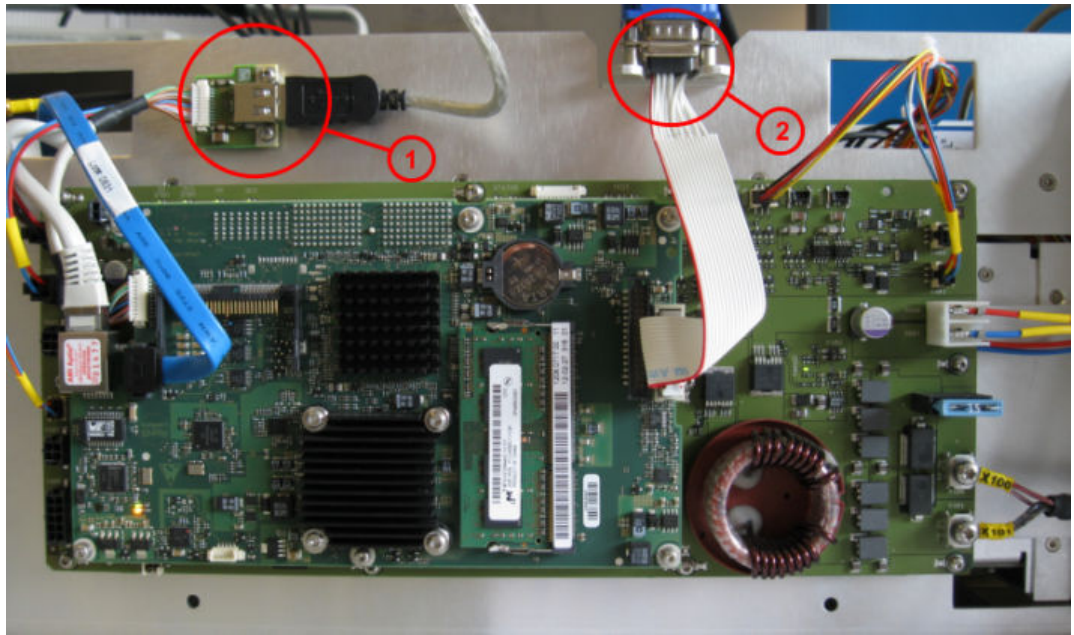


Fig. 4-2: Connectors for keyboard and mouse

- 1 = USB connector
- 2 = VGA connector

If you want to connect a USB memory stick and the keyboard simultaneously, use a USB hub.

4.1.3 Updating the R&S UMS300 Application

An update of the R&S UMS300 application is available as an executable file that must be copied to the R&S UMS300 and executed locally.

This can be done in two different ways: Open the device, connect the keyboard and the monitor (see [chapter 4.1.2, "Connecting the Keyboard, Mouse and Monitor"](#), on page 44) and copy the file from a USB memory stick to the system computer.

Or copy the file from an external computer via Remote Desktop to the system computer and execute it. The second way is the standard procedure, so it will be described here.

1. Connect via Remote Desktop to the system computer of the R&S UMS300 (see [chapter 4.1.1, "Access via Windows Remote Desktop"](#), on page 43).
2. Copy the update file to the system computer.
3. Double-click the file to execute it.

The start window of the R&S Software Distributor opens.



Fig. 4-3: R&S Software Distributor, window 1

4. Keep the "Local Installation" option selected and click "Next".

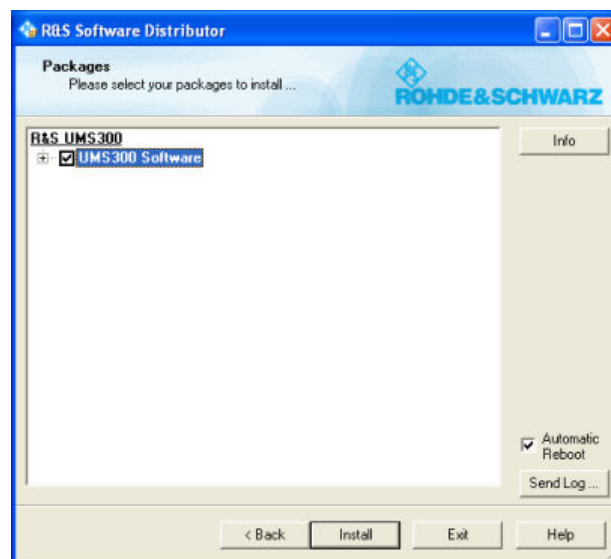


Fig. 4-4: R&S Software Distributor, window 2

5. In the next window select the option "UMS300 Software" and click "Install".

The installation runs automatically without any further user interaction and will be terminated by a reboot.

4.2 Receiver Firmware Update



Before loading the new receiver firmware make sure that it is supported by the R&S Argus system software. Incompatible firmware may be the cause of malfunctions.

1. First of all copy the firmware file of the R&S EB500 via a Remote Desktop connection to the system computer of the R&S UMS300 in the same way as when updating the R&S UMS300 application (see [chapter 4.1.3, "Updating the R&S UMS300 Application"](#), on page 45).

The actual update is performed using the `Update32.exe` program.

2. Open "Start" > "All Programs" > "Update32" and double-click the program to start it.

Once started the program comes up with the window as shown below.

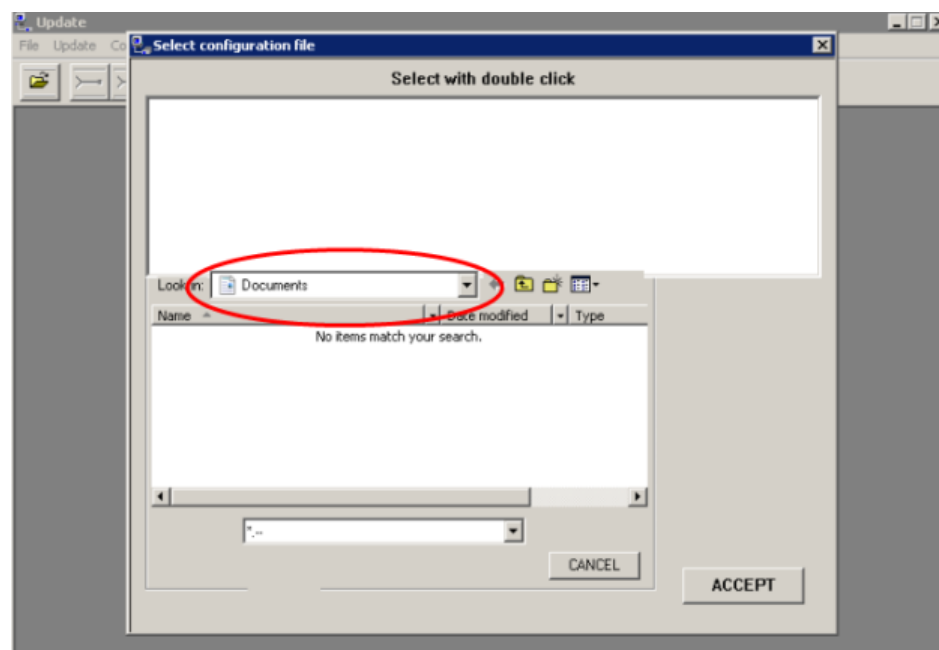


Fig. 4-5: Update32 application after start-up

3. Select the directory with the firmware file using the file selector as shown in the screenshot above.

The firmware version is displayed.

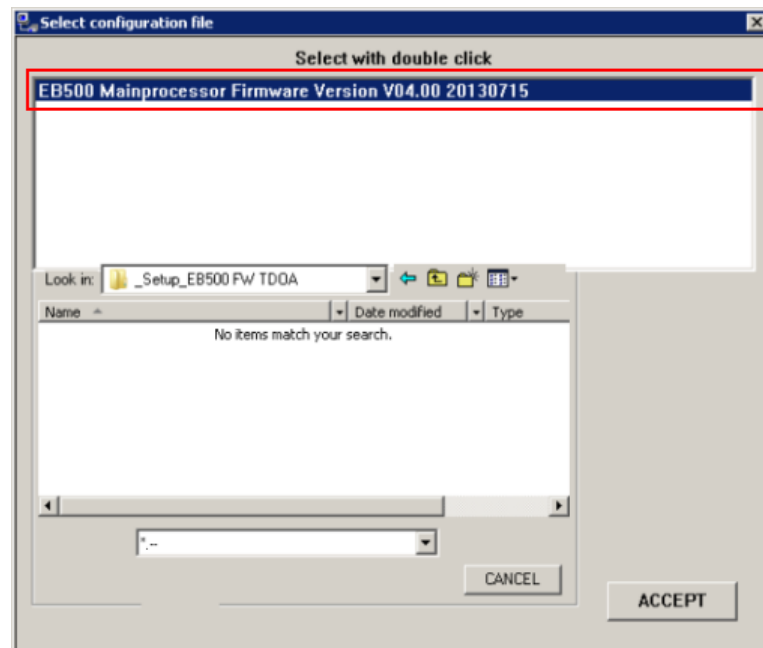


Fig. 4-6: Update32 application with loaded firmware

4. Double-click the firmware to select it.

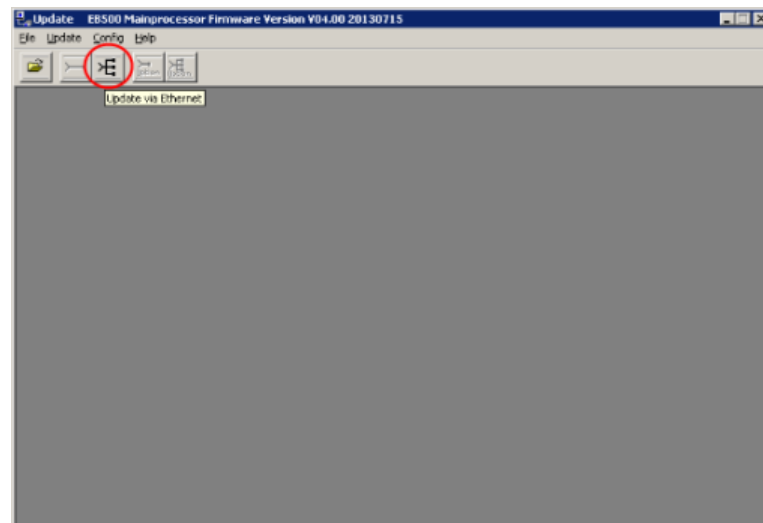
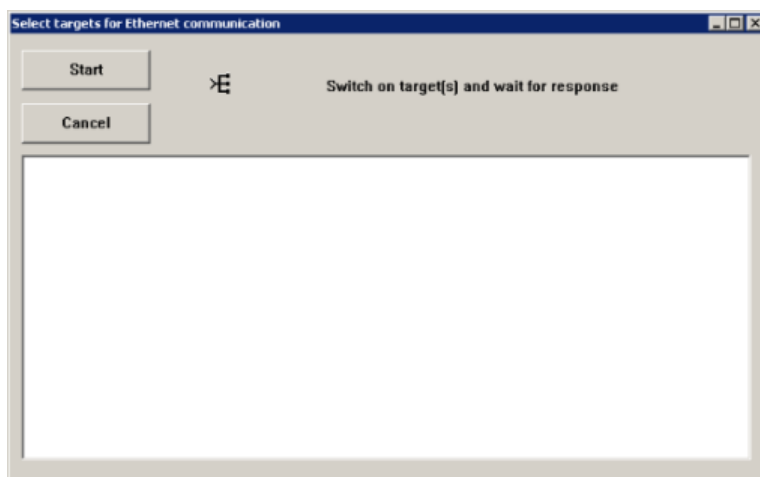


Fig. 4-7: Update32 application after firmware selection

5. Click the icon indicated in the screenshot above to start the update.
The window shown below opens.



- Restart the receiver. For this open a cmd window and enter the command `telnet 192.168.29.2 5555`.

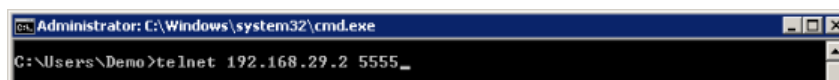


Fig. 4-8: Telnet to receiver

Depending on the Telnet client version, it may occur that the window remains blank after connection and you don't even see a cursor. Nevertheless, you are connected with the receiver, unless an error message is displayed.

- Enter the command `*idn?` and confirm with ENTER.

You get an indication with the device name and the current firmware version as shown below.

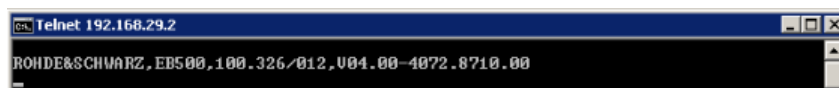


Fig. 4-9: Indication of the receiver firmware

- Restart the receiver by entering the `system:reset` command and confirm with ENTER.

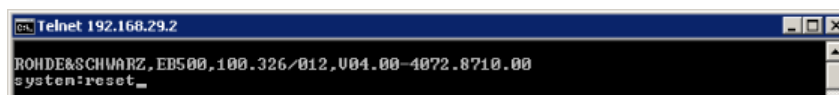


Fig. 4-10: Command to restart the receiver

Briefly afterwards the Update32 window indicates the receiver with its name and firmware version.

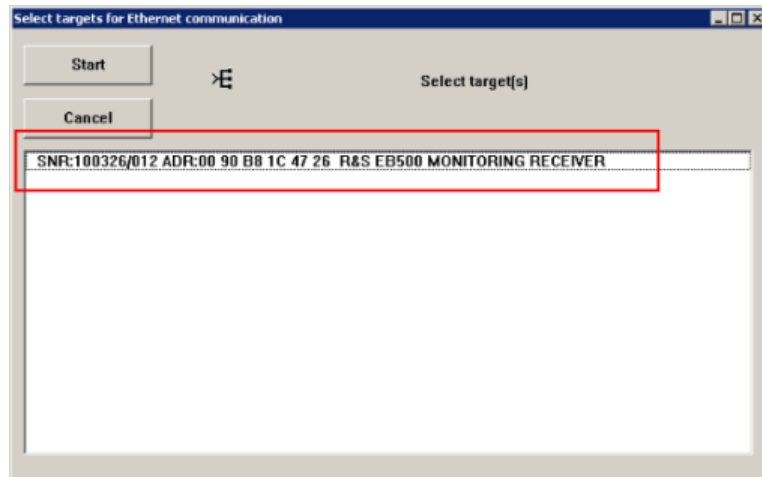


Fig. 4-11: Update32 application after receiver restart

9. Select the receiver and click "Start" to execute the update.
First the old firmware on the receiver is deleted, before the new one is loaded.

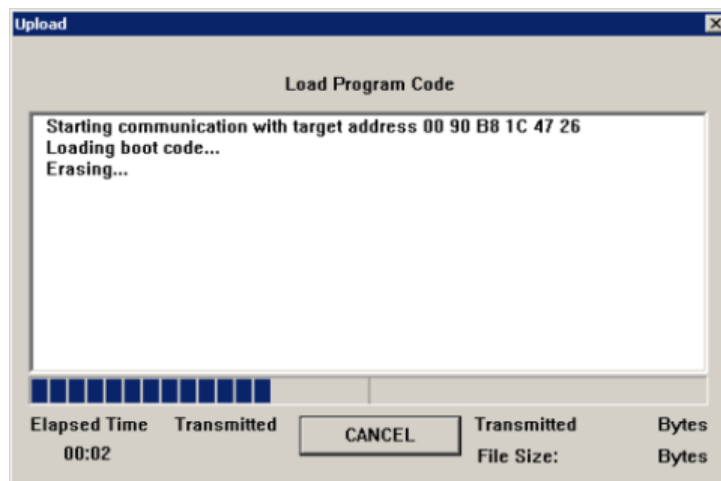


Fig. 4-12: Update32 application after starting the update

The update takes some time to complete. Finally the application shows a completion message.

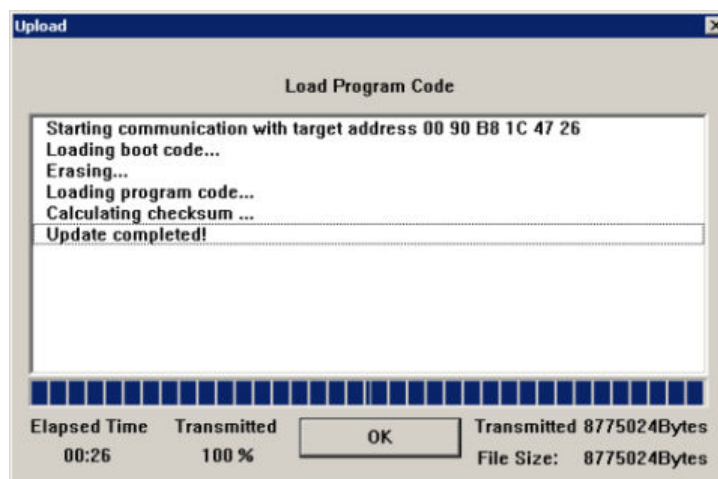


Fig. 4-13: Update32 application after completing the update



Make sure not to disconnect the system computer from the receiver while the update is running.

4.3 Router

The router used in the R&S UMS300 is a MikroTik RouterBOARD. Routers from this manufacturer are used around the world and support a number of protocols and functions.

When delivered, these routers have a standard configuration which trained users should be capable of modifying to meet their specific requirements.

This manual describes how to access the user interface of the router and how to load a configuration created and supplied by Rohde & Schwarz into the R&S UMS300 system.

For further information on configuring MikroTik routers, see the manufacturer's online manual: <http://wiki.mikrotik.com/wiki/Manual:TOC>.

4.3.1 Winbox

MikroTik Winbox uses broadcasts to detect MikroTik routers in the local area network (LAN).

This software is installed by default on the system computer of the R&S UMS300. It can also be launched from an external computer if the computer is connected via the X20 connector (Ethernet-WAN) to the R&S UMS300 (see [chapter 3.3, "Local Operation"](#), on page 36).



Ex works the connector X21 Ethernet-LAN is "blocked" by firewall rules. To establish a connection to this connector the firewall must be deactivated first (see ["Enabling the LAN port for maintenance or operation of an additional system device \(R&S FU129\)"](#) on page 24).

1. Navigate to directory
C:\ProgramFiles\Rohde-Schwarz_Tools_Setup_UMS300-Router\ and double-click Winbox to start it.
2. Click the "Neighbors" tab shown in the figure to scan for the router.

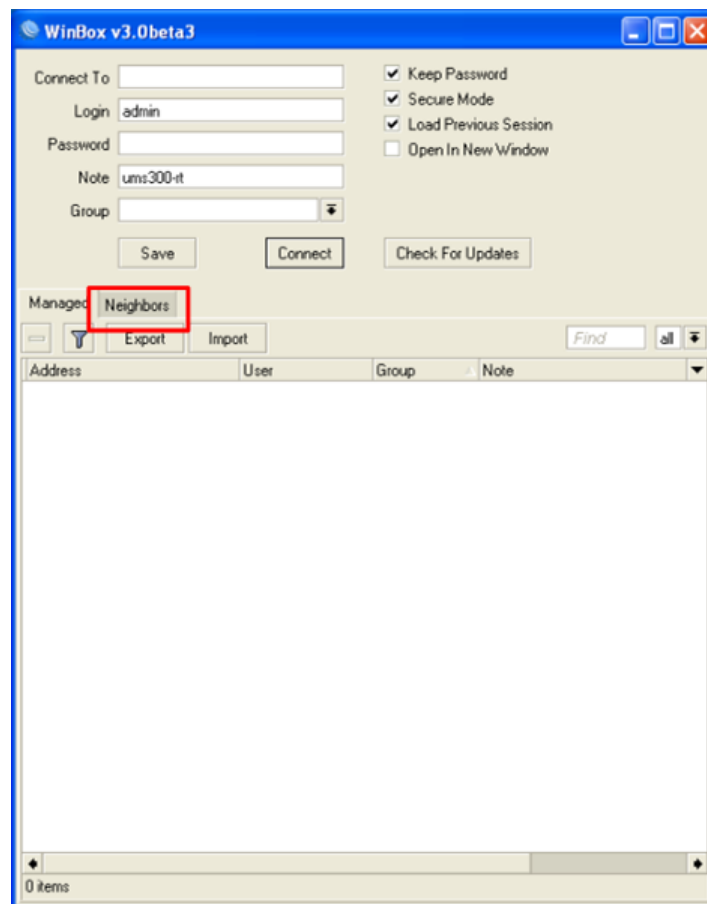


Fig. 4-14: Winbox start window

A selection screen with the MAC and IP addresses of the router should open.

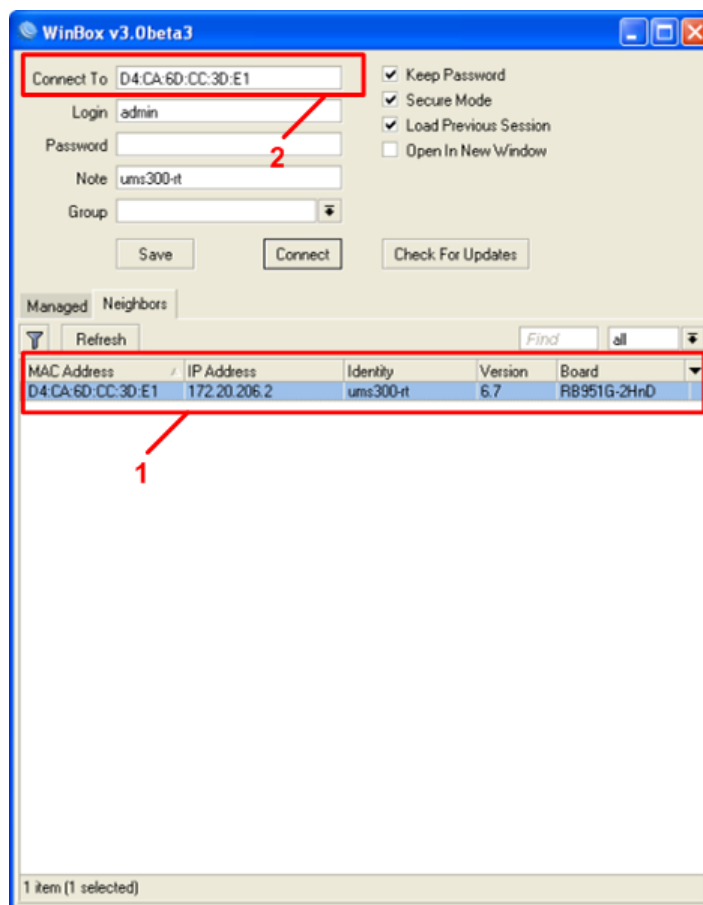


Fig. 4-15: Winbox selection screen

3. Click the MAC address.
It will be taken to the "Connect To" input box.
4. If necessary, enter the password (ex works the R&S UMS300 router has the password "radmon").
5. Click "Connect" to establish the connection to the router.
The Winbox window should open.
6. If the IP address of the router is known, you can also enter it directly into the "Connect To" input box.

See <http://wiki.mikrotik.com/wiki/Winbox>.

4.3.2 Firmware Update

A firmware update for the router is typically required on the R&S UMS300 if new functions are implemented in the system that are not supported by the old version of the router firmware.

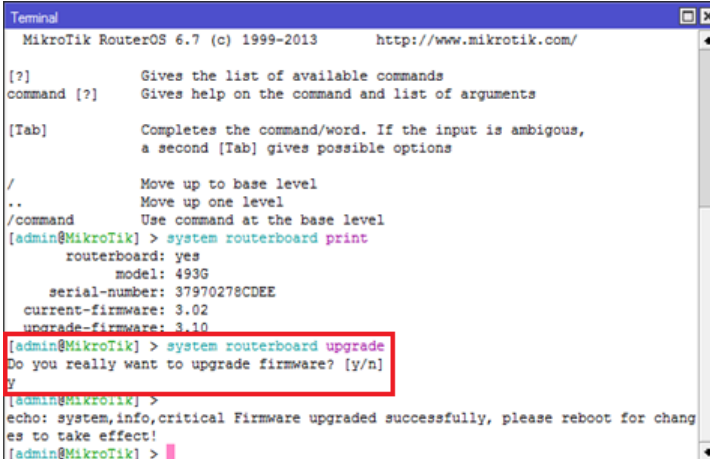
Together with new firmware for the other system components (receiver, system computer, etc.), new firmware is also supplied for the routers by Rohde & Schwarz.

Proceed as follows to update the router:

1. Connect to the router using the "Winbox" software (see [chapter 4.3.1, "Winbox"](#), on page 51).
2. Open the "Files" window.
3. Drag and drop the update files to this window.

Note: Make sure the files are saved in the root directory (and not in one of its folders).

4. Restart the router, e.g. by entering the command `/system reboot` and answering the following query with `y`. Winbox loses the connection and the router boots with the new firmware.
5. Reconnect to the router and open a terminal window.
6. Execute the command `system routerboard upgrade` and answer the query with `y` to update the boot loader.



```
Terminal
MikroTik RouterOS 6.7 (c) 1999-2013      http://www.mikrotik.com/

[?]          Gives the list of available commands
command [?]  Gives help on the command and list of arguments

[Tab]       Completes the command/word. If the input is ambiguous,
            a second [Tab] gives possible options

/           Move up to base level
..         Move up one level
/command   Use command at the base level
[admin@MikroTik] > system routerboard print
routerboard: yes
model: 493G
serial-number: 37970278CDEE
current-firmware: 3.02
upgrade-firmware: 3.10
[admin@MikroTik] > system routerboard upgrade
Do you really want to upgrade firmware? [y/n]
y
[admin@MikroTik] >
echo: system,info,critical Firmware upgraded successfully, please reboot for changes to take effect!
[admin@MikroTik] >
```

7. Restart the router.

The new boot loader will be activated after the router is restarted.

4.3.3 Modifying the Configuration

Management of configurations using the MikroTik RouterOS is beyond the scope of this manual.

MikroTik RouterOS is a very popular and well documented operating system, and trained personnel should have no trouble using this operating system and adapting the configuration to meet their specific requirements.

For details see the manufacturer's online manual at: <http://wiki.mikrotik.com/wiki/>.

4.3.4 Resetting and Loading a Configuration

Reset

1. Connect to the router as described in [chapter 4.3.1, "Winbox"](#), on page 51.
2. Use the "New Terminal" menu to open a terminal window and enter the command to reset the configuration as shown in the screenshot.

The command is `system reset-configuration no-default=yes`.

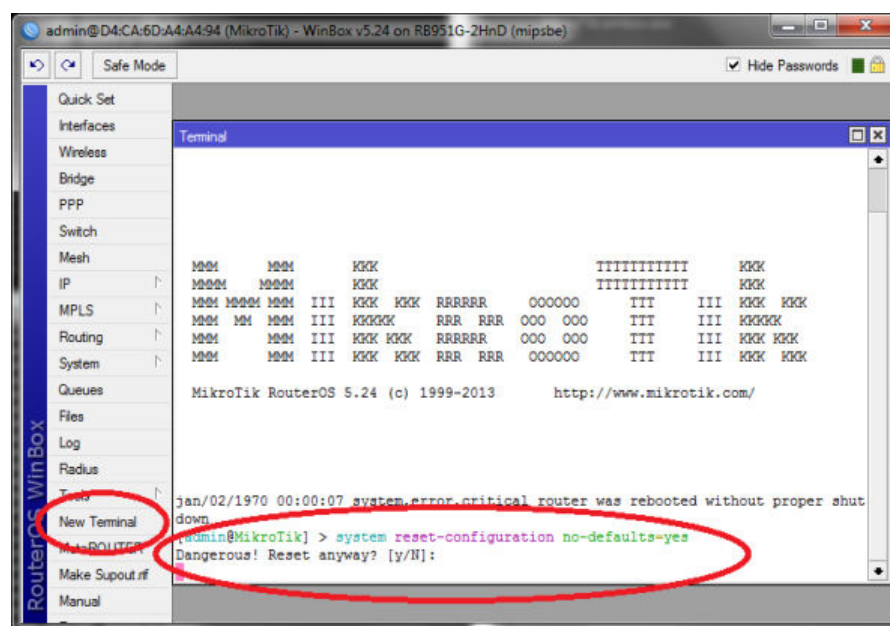


Fig. 4-16: Winbox system reset

3. Confirm the reset operation by typing the letter `y`.

When the configuration is reset, Winbox loses the connection to the router.

Loading a configuration supplied by Rohde & Schwarz

A router configuration supplied by Rohde & Schwarz comes in the form of a text file with the relevant commands (batch file).

1. Connect to the router as described above (see [chapter 4.3.1, "Winbox"](#), on page 51) and open a terminal window.
2. Open a text file with the router configuration in Windows Notepad.

Note: Do not use any other tool but Windows Notepad. Other editors transmit control characters that will be misinterpreted by the terminal.

3. Copy the entire content of the text file to your computer's clipboard and then paste the content of the clipboard into the terminal window.

All of the commands are executed in sequence and saved.

Note: To paste the text into the Winbox terminal window right-click the window and from the context menu select the "Paste" command. CTRL+V does not work here.

The connection to the router is interrupted after the commands are loaded. If you wish to verify the new settings, reconnect Winbox to the router as described above.

4.4 Checking the System Components

The R&S UMS300 requires no maintenance if it is properly installed and protected against solar radiation. Occasionally, a visual inspection should be performed to check for damage. During this inspection, the connections for the antennas and the external components (such as the GPS, 3/4G antenna, etc.) should be examined. The cables should be inspected to ensure that they are in good condition. Damage can allow water to penetrate into the cables and render them useless. This chapter describes the possibilities for troubleshooting if one of the components is no longer working properly. In order for the troubleshooting to be successful, the system must have a properly functioning power source and an (internal or external) system computer.

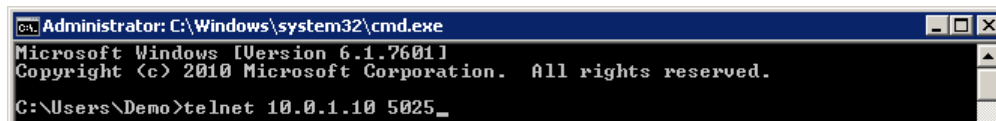
4.4.1 Checking the Internal Operating Voltages

If one of the components does not work correctly, first of all check the internal operating voltages. This test can be performed using either the system computer (see [chapter 4.1.1, "Access via Windows Remote Desktop"](#), on page 43) or an external PC connected at X21 LAN (see [chapter 3.3, "Local Operation"](#), on page 36).



In the factory default state, the LAN port can only be reached via SSH. In order to be able to perform the procedure via X21 as described below, the firewall rules must be deactivated first (see [chapter "Enabling the LAN port for maintenance or operation of an additional system device \(R&S FU129\)"](#) on page 24).

1. Open a cmd window and enter the command `telnet 10.0.1.10 5025` to connect to the power control board.



```
Administrator: C:\Windows\system32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2010 Microsoft Corporation. All rights reserved.
C:\Users\Demo>telnet 10.0.1.10 5025_
```

Fig. 4-17: Telnet connection to the power control board

Depending on the Telnet client version, it may occur that the window remains blank after connection and you don't even see a cursor. Nevertheless, you are connected with the receiver, unless an error message is displayed.

2. Enter the command `*idn?` and confirm with ENTER.

Information about the device is displayed (serial number, firmware version,...). From now you will see the echo of what you have entered.

3. Enter the command `diag:serv:stes;*opc?` (no echo may be visible) and confirm with ENTER.

As a response to the command the number "1" should be output.

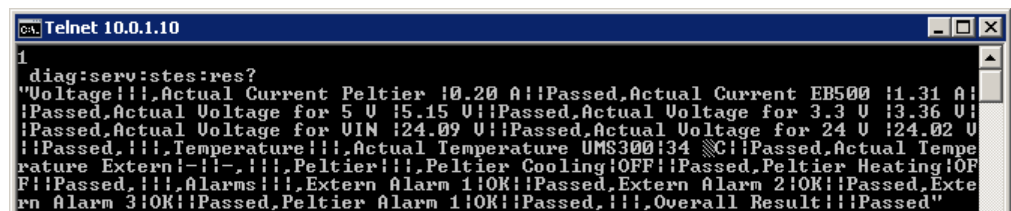


```
Telnet 10.0.1.10
1
```

Fig. 4-18: Output of command `diag:serv:stes;*opc?`

4. Enter the command `diag:serv:stes:res?` to read the result of the self-test.

Note: The self-test may take some time. After starting the self-test wait approximately 10 seconds before you request the result.



```
Telnet 10.0.1.10
1
diag:serv:stes:res?
"Voltage!!!,Actual Current Peltier !0.20 A!!Passed,Actual Current EB500 !1.31 A!
!Passed,Actual Voltage for 5 U !5.15 U!!Passed,Actual Voltage for 3.3 U !3.36 U!
!Passed,Actual Voltage for UIN !24.09 U!!Passed,Actual Voltage for 24 U !24.02 U
!!Passed,!!!,Temperature!!!,Actual Temperature UMS300!34 C!!Passed,Actual Tempe
rature Extern!-!-!-!!!,Peltier!!!,Peltier Cooling!OFF!!Passed,Peltier Heating!OF
F!!Passed,!!!,Alarms!!!,Extern Alarm 1!OK!!Passed,Extern Alarm 2!OK!!Passed,Exte
rn Alarm 3!OK!!Passed,Peltier Alarm 1!OK!!Passed,!!!,Overall Result!!!Passed"
```

Fig. 4-19: Output of self-test result

The output is unformatted. The result display for a properly working device contains the following information:

```

[Voltage||,Actual Current Peltier |0.20 A||Passed,Actual Current EB500 |1.40 A|
|Passed,Actual Voltage for 5 V |5.13 V||Passed,Actual Voltage for 3.3 V |3.33 V|
|Passed,Actual Voltage for VIN |23.89 V||Passed,Actual Voltage for 24 V |23.86 V
||Passed,||,Temperature||,Actual Temperature UMS300|36 ||C||Passed,Actual Tempe
rature Extern|-||-,||,Peltier||,Peltier Cooling|OFF||Passed,Peltier Heating|OF
F||Passed,||,Alarms||,Extern Alarm 1|OK||Passed,Extern Alarm 2|OK||Passed,Exte
rn Alarm 3|OK||Passed,Peltier Alarm 1|OK||Passed,||,Overall Result||Passed"

```

```

"Voltage
Actual Current Peltier          0.20 A          Passed
Actual Current EB500           1.40 A          Passed
Actual Voltage for 5 V         5.13 V          Passed
Actual Voltage for 3.3 V       3.33 V          Passed
Actual Voltage for VIN         23.89 V         Passed
Actual Voltage for 24 V       23.86 V         Passed

Temperature
Actual Temperature UMS300     36 C            Passed
Actual Temperature Extern

Peltier
Peltier Cooling               OFF             Passed
Peltier Heating               OFF             Passed

Alarms
Extern Alarm 1                OK              Passed
Extern Alarm 2                OK              Passed
Extern Alarm 3                OK              Passed
Peltier Alarm 1               OK              Passed
Overall Result                Passed"

```

Fig. 4-20: Output of self-test result - lower part formatted

4.4.2 Checking the System Computer

If you have any doubts whether the system computer is in proper working order, a monitor, a keyboard and a mouse should be connected to the corresponding interfaces as described in [chapter 4.1.2, "Connecting the Keyboard, Mouse and Monitor"](#), on page 44.

The system must be opened for this purpose (see [chapter 4.5, "Opening the R&S UMS300"](#), on page 64).

If necessary, switch off the R&S UMS300 by disconnecting it from the power supply and then reconnect the power supply.

Observe the output on the monitor.

- Does the system computer start normally?
- Does the operating system boot?
- Are you able to start programs?
- Is it possible to control the system using the installed monitoring software?

4.4.3 Checking the Ethernet Interface of the System Computer

For this test, it is necessary to open the device (see [chapter 4.5, "Opening the R&S UMS300"](#), on page 64).

Check the Ethernet interface's basic functionality:

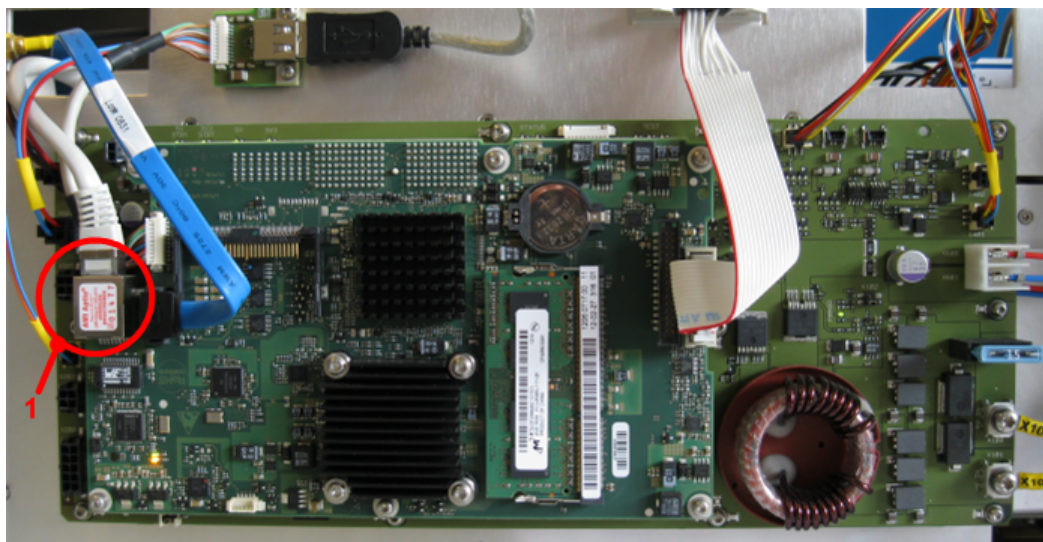


Fig. 4-21: Ethernet interface of the system computer

1. Switch on the R&S UMS300 and connect the Ethernet interface to a LAN switch using a LAN patch cable.
2. Check if the LINK LED lights up on the LAN switch after a short period.

If a link has been successfully established, check the communications via the LAN interface:

1. Connect an external PC to the LAN switch using a patch cable.
2. Assign the external PC an IP address in the same subnet as the IP address for the system computer of the R&S UMS300 (e.g. 192.168.29.3 /24).
3. On the external PC open a "cmd" window and "ping" the system computer's IP address (`ping 192.168.29.1`).

If there is a response to the ping, communication via the system computer's LAN interface works.

4.4.4 Checking the Receiver

The receiver is connected to the system via an Ethernet interface.

This test can be performed by the system computer using Remote Desktop or by an external computer connected to the system as described in [chapter 3.3, "Local Operation"](#), on page 36.

1. First check the receiver's communications with the system computer. To do this, begin by opening a "cmd" window on the system computer and "pinging" the receiver's IP address. Enter the following command: `ping 192.168.29.2`.
2. If the receiver replies to the ping, you can check to see if the receiver is in basic working order:
 - a) Open a "Telnet" session on the receiver (to do this, enter the following into the "cmd" window: `telnet 192.168.29.2 5555`).
 - b) Enter the command `*idn?` and confirm with ENTER. The receiver should output a report with the current firmware version. (Note that your input will not be visible since there is no echo!) Only the receiver's output will be displayed.)



For details on other diagnostic options refer to the R&S EB500 manual. Chapter 4 Remote Control via LAN Interface provides detailed information on how to control the device via SCPI commands and to perform a diagnose on individual components. Chapter 5.2 Repair describes how to proceed for servicing as well as removing and re-installing of R&S EB500 modules.

The optional R&S UMS30-HF is operated and serviced just like the optional R&S EB500-HF, therefore for servicing proceed as described for the R&S EB500-HF.

4.4.5 Checking the Router via X21 Ethernet-LAN and X20 Ethernet-WAN

If you have any doubts whether the router is in proper working order (e.g. if the R&S UMS300 is no longer accessible via remote control), first of all check whether the router becomes accessible when you connect an external PC to the external interfaces X20 and X21.

1. First connect the external PC to interface X20 (WAN) using an Ethernet patch cable.
2. Connect to the router using the Winbox software (see [chapter 4.3.1, "Winbox"](#), on page 51).

If Winbox can contact to the router, the router is basically working. Now you can check the configuration for possible causes.

3. Repeat this test with interface X21 (LAN). Before you start deactivate the firewall for this port (see ["Enabling the LAN port for maintenance or operation of an additional system device \(R&S FU129\)"](#) on page 24).

4.4.6 Setting Up Access via X20 Ethernet-WAN



The interface X20 Ethernet-WAN routes only certain protocols and applications to the R&S UMS300 system computer: All applications required for operation of the R&S Argus system software as well as e.g. Windows Remote Desktop or some applications required for maintenance purposes.

If you need unlimited access to the R&S UMS300 system computer, select X21 Ethernet-LAN as your access point. Before you start deactivate the firewall for this port (see [chapter 2.4.3, "Ethernet-LAN Interface \(X21 LAN\)"](#), on page 24).

Ex works the port X20 Ethernet-WAN is set up to receive IP addresses via DHCP.

If there is no DHCP server that can be reached, no IP address will be assigned to this interface, so it cannot be addressed via IP. The interface can only be addressed via the MAC address (e.g. by using the `Winbox.exe` tool).

For access via a layer 3 protocol (IP) use a router with DHCP server function. The following describes how to proceed (this setup corresponds to the second scenario described above, see [chapter 1.4, "R&S UMS300 as Part of a Sensor Network"](#), on page 12).

1. The hardware required for this configuration comprises a MikroTIK router with at least five Gigabit Ethernet connectors (e.g. RB951G-2HnD).
2. Connect an external PC to the "Ethernet 2" interface using a LAN switch or cross-over cable (with MikroTIK devices straight from the plant, port 1 is not yet set up for access via "Winbox").
3. Start `Winbox.exe` and connect to the router as described in [chapter 4.3.1, "Winbox"](#), on page 51.
4. Reset the existing configuration of the router as described in [chapter 4.3.4, "Resetting and Loading a Configuration"](#), on page 55.
5. After the router has restarted reconnect to it using "Winbox", open a new terminal window and copy and paste the first part of the configuration given below into the terminal window. Winbox may then lose the connection to the router.
6. If necessary, reconnect to the router and copy and paste the second part of the configuration.

Connect X20 of the R&S UMS300 via a LAN switch or crossover cable to port 5 of the router you have just set up. The R&S UMS300 will obtain the IP address 172.20.206.100 assigned by the DHCP server and after approximately two minutes it will set up an encrypted tunnel to the router.

7. Assign your external PC an IP address in the subnetwork 192.168.1.0/24 and enter the router address 192.168.1.1 as default gateway. You can now use your external PC connected at port 2 to access the R&S UMS300 by using the IP address 172.20.200.100 as target address.

8. To check if the device is accessible at all you can "ping" it: There should be an answer to `ping 172.20.206.100`.
9. If this is the case, connect to the R&S UMS300 system computer via Windows Remote Desktop by using the IP address 172.20.206.100 as target address for the RDP session. Log in to the system computer with the user name "demo" and password "radmon".

Configuration part 1

```
/interface ethernet
set [ find default-name=ether1 ] name=ether1-DSL
set [ find default-name=ether2 ] name=ether2-LAN
set [ find default-name=ether3 ] master-port=ether2-LAN
set [ find default-name=ether4 ] master-port=ether2-LAN
set [ find default-name=ether5 ] name=ether5-WAN
```

Configuration part 2

```
/ip pool
add name=dhcp_pool2 ranges=172.20.206.100-172.20.206.100

/ip dhcp-server
add add-arp=yes address-pool=dhcp_pool2 disabled=no interface=ether5-WAN \
name=dhcp1 src-address=172.20.206.1

/ip address
add address=192.168.1.1/24 interface=ether2-LAN network=192.168.1.0
add address=172.20.206.1/16 interface=ether5-WAN network=172.20.0.0

/ip dhcp-server network
add address=172.20.0.0/16 gateway=172.20.206.1

/ip ipsec proposal
set [ find default=yes ] enc-algorithms=aes-256-cbc

/ip ipsec peer
add enc-algorithm=aes-256 exchange-mode=main-l2tp generate-policy=\
port-override secret=ThisKeyIsSecret! send-initial-contact=no

/system identity
set name=hq-rt
```

4.4.7 Checking the 3/4G Wireless Module

To check the 3/4G wireless module the Winbox software is required (see [chapter 4.3.1, "Winbox"](#), on page 51).

1. Connect to the router as described in [chapter 4.3.1, "Winbox"](#), on page 51.

2. Open a new terminal window and enter the command `interface lte info`.
3. Enter the interface number (normally 0).

Information about the current provider, the signal strength and the service used will be displayed.

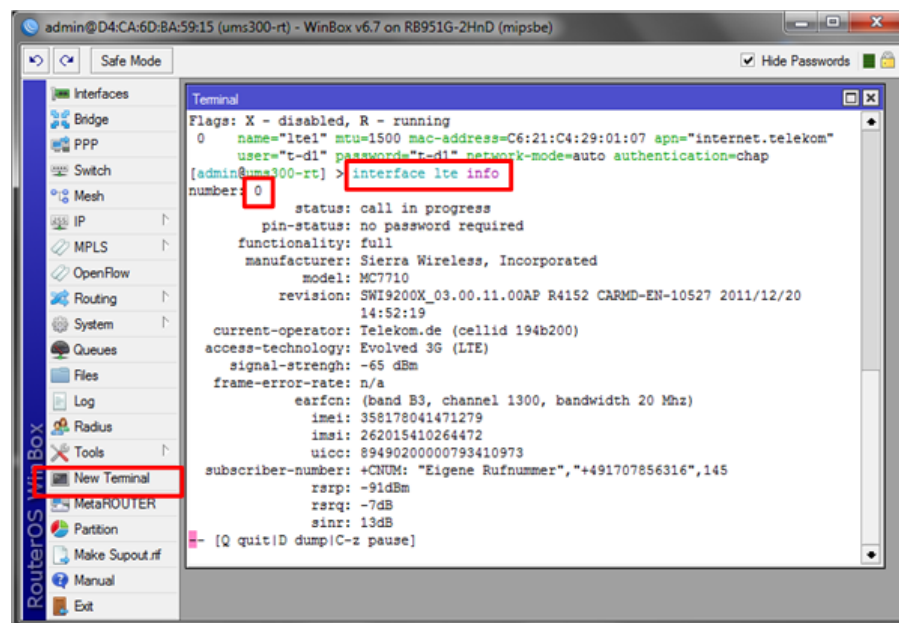
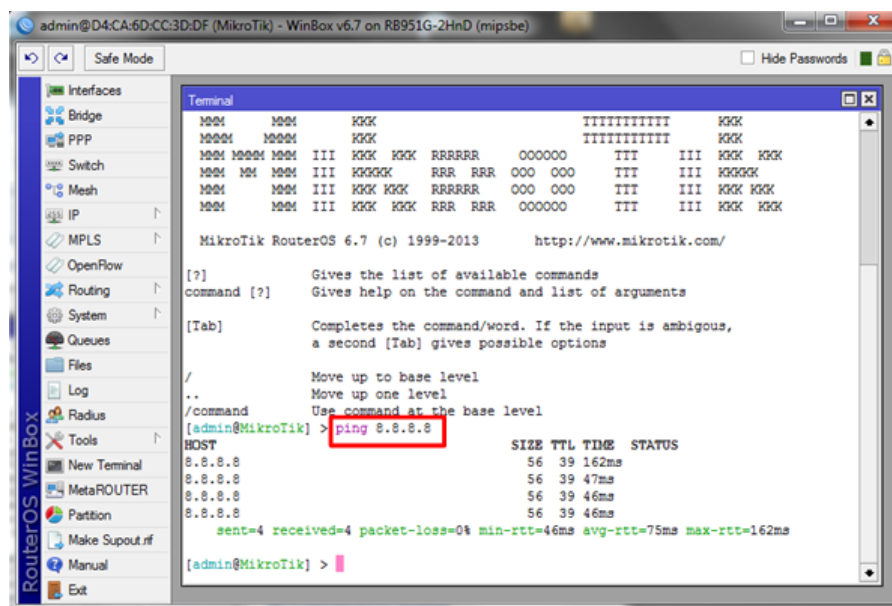


Fig. 4-22: Information about the LTE interface

The following parameters indicate whether the modem is logged into a mobile communications network, which service is being used and what the signal quality is like:

| | |
|-------------------|---|
| current-operator | Network provider used |
| access-technology | Service used (UMTS, HSPA, LTE) |
| signal-strength | Signal strength (should be better than -70 dBm) |

Now you can open a terminal window and "ping" a public IP address (e.g. Google name server 8.8.8.8) in order to check if you have a connection to the Internet.



4.5 Opening the R&S UMS300

For certain diagnostic and maintenance tasks the device must be opened.



Disconnect all cables from the device (power supply, antenna, network cables) before opening it!

1. Stand the R&S UMS300 on its top so that the connection panel faces upwards.
2. Undo the four screws at the bottom of the device (see [figure 4-23](#)).

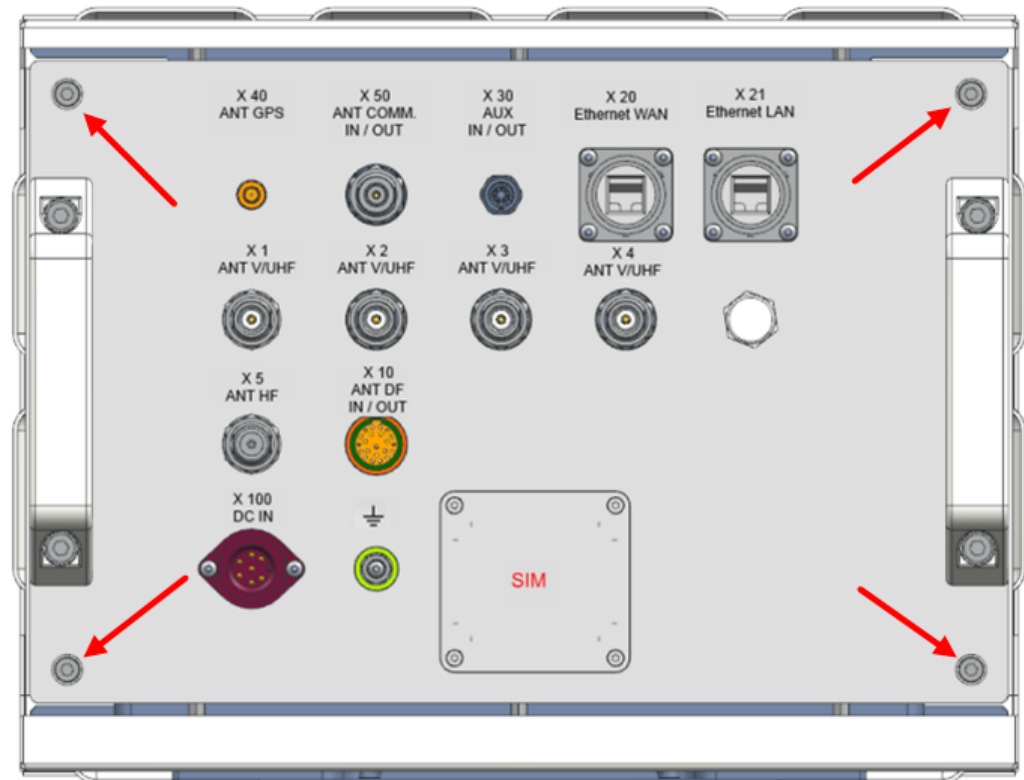


Fig. 4-23: Screws to be undone before opening the device

3. Take hold of the two handles and carefully pull the device to the top and out of the housing.

CAUTION

The power cable for the Peltier element is still connected to the power supply board. Preferably, a second person should disconnect the cable from the power supply board.



Replace the rubber seal at the bottom of the housing before reassembly.

4.6 Checking the LEDs

Power supply board

If it is suspected that individual components are not functioning properly, it is worth checking the LEDs and the fuses. For this test, it is necessary to open the device (see [chapter 4.5, "Opening the R&S UMS300"](#), on page 64).

If the device is switched on and in proper working order, the LEDs marked in [figure 4-24](#) and [figure 4-25](#) are lit. If this is not the case, first check the fuses and replace them, if necessary (see [chapter 4.7, "Checking the Device Fuses"](#), on page 67). The individual components are equipped with fuses.

In [figure 4-24](#) the power supply board with mounted LPC is shown. The LEDs are arranged in such way that they are visible even in this setup.



LED groups 2 and 3 are irrelevant for the status check. They are merely used for software development purposes.

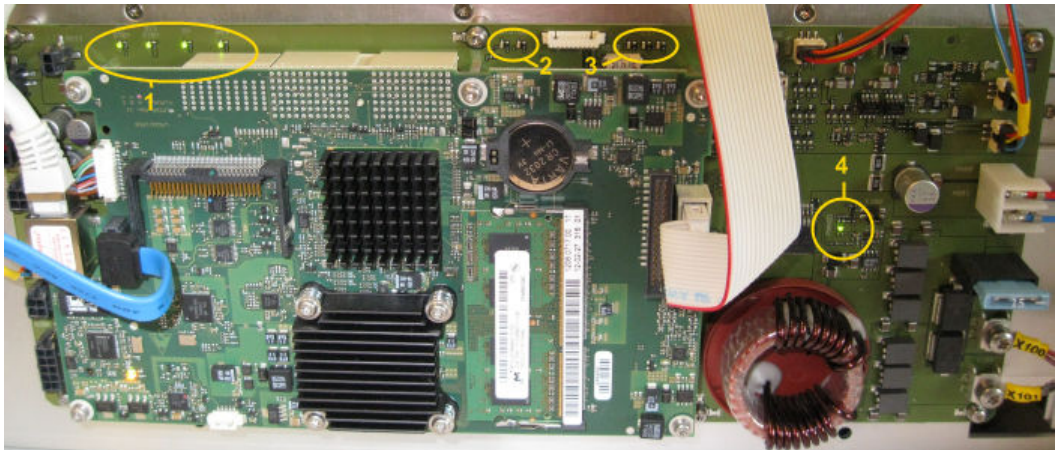


Fig. 4-24: LEDs on the power supply board

| No. | Description |
|-----|--|
| 1 | Main input voltages 5 V and 3.3 V |
| 2 | Status - irrelevant, used for software development |
| 3 | Test - irrelevant, used for software development |
| 4 | Power good (input power in the permitted range) |

Router



Fig. 4-25: LEDs on the router board

| No. | Description |
|-----|--|
| 1 | Link and activity LED for Ethernet ports 1 to 5 |
| 2 | User LED - normally off, flashes during the boot process |
| 3 | Power LED - input voltage |

4.7 Checking the Device Fuses

This chapter provides information about the location and properties of the fuses. The SMD fuses can be carefully removed from the socket using pliers and checked for continuity with an ohmmeter.

In [figure 4-26](#) the power supply board without LPC is shown. Some of the fuses are located below the LPC board, which has to be removed first when fuses are to be replaced.

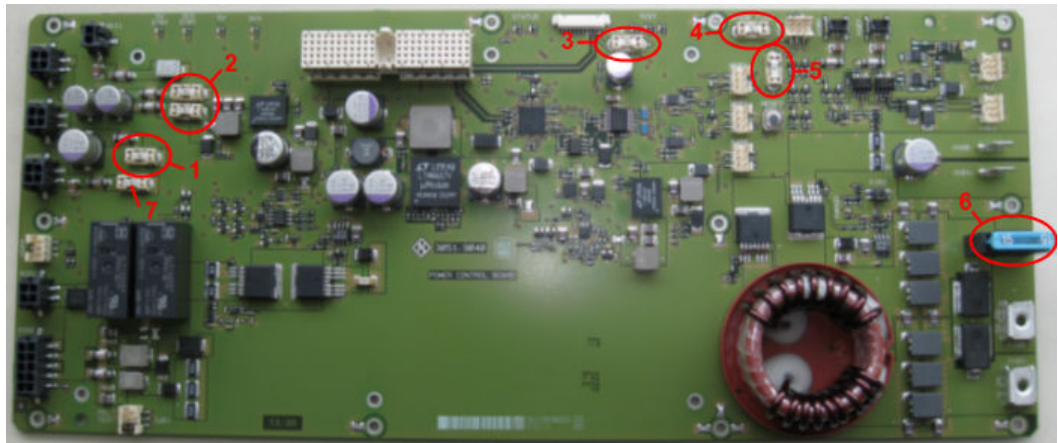


Fig. 4-26: Location of fuses on the power supply board

| No. | Description |
|-----|---|
| 1 | Voltage supply for router, SMD 1 A FF |
| 2 | SATA, SMD 1 A FF |
| 3 | USB, SMD 1 A FF |
| 4 | Spare fuse without function, SMD 1 A FF |
| 5 | RF switch, SMD 1 A FF |
| 6 | Main input voltage, 15 A |
| 7 | Standby voltage, T 1 A |



Fuse No. 4 is a spare fuse that can be used to replace a defective fuse, if necessary.

4.8 Resetting the Microcontroller

In very rare cases the microcontroller of the power supply board may crash. A reset button on the board is provided to reset it.

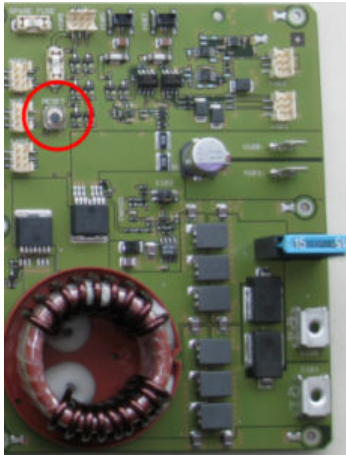


Fig. 4-27: Reset button on the power supply board

5 Annex

5.1 Block Diagrams

Block diagrams: Circuit diagram 3051.7701.01 S

5.2 Interface Description

DC IN X100

Male panel mount connector 6 PINs + E MAINS




| Designation | In/ Out | | PIN No. | Connector |
|-------------|------------|------------------------------------|---------|-----------|
| +24VDC | I | +22 V DC to 26 V DC / max. 15 A | 1 | X100 |
| +24VDC | I | +22 V DC to 26 V DC / max. 15 A | 2 | X100 |
| +24VDC | I | +22 V DC to 26 V DC / max. 15 A | 3 | X100 |
| GND | I | Ground | 4 | X100 |
| GND | I | Ground | 5 | X100 |
| GND | I | Ground | 6 | X100 |
| Ground | I | Ground connection | 7 | X100 |

Ground connection

Threaded bolt, M6 metric ISO threading



| Designation | In/Out | | PIN No. | Connector |
|-------------|--------|-----------------|---------|---|
| Ground | | Ground terminal | |  |

RF IN 1-4 X1 to X4

N-type female 50 Ω



| Designation | In/Out | | PIN No. | Connector |
|-------------|--------|-----------------------|---------|-----------|
| RF IN 1-4 | I | 20 MHz to 6 GHz; 50 Ω | | X1 to X4 |

ANT HF X5

N-type female 50 Ω



| Designation | In/Out | | PIN No. | Connector |
|-------------|--------|------------------------|---------|-----------|
| RF IN | I | 9 kHz to 32 MHz / 50 Ω | | X5 |

ANT DF IN/OUT X10

Female panel mount connector MIL



| Designation | In/Out | | PIN No. | Connector |
|-------------|--------|---------------------------|---------|-----------|
| +18VDC | O | +18 V DC / max. 1 A | 1 | X10 |
| +18VDC | O | +18 V DC / max. 1 A | 2 | X10 |
| +18VDC | O | +18 V DC / max. 1 A | 3 | X10 |
| +18VDC | O | +18 V DC / max. 1 A | 4 | X10 |
| GND | P | GND | 5 | X10 |
| GND | P | GND | 6 | X10 |
| GND | P | GND | 7 | X10 |
| GND | P | GND | 8 | X10 |
| ANT3+ | O | RS-422 (2 V to 4 V diff.) | 9 | X10 |
| ANT4+ | O | RS-422 (2 V to 4 V diff.) | 10 | X10 |
| ANT5+ | O | RS-422 (2 V to 4 V diff.) | 11 | X10 |
| ANT5- | O | RS-422 (2 V to 4 V diff.) | 12 | X10 |
| COM1+ | B | RS-485 (min. 1.5 V diff) | 13 | X10 |
| COM1- | B | RS-485 (min. 1.5 V diff) | 14 | X10 |
| ANT0+ | O | RS-422 (2 V to 4 V diff.) | 15 | X10 |
| ANT0- | O | RS-422 (2 V to 4 V diff.) | 16 | X10 |
| ANT1+ | O | RS-422 (2 V to 4 V diff.) | 17 | X10 |
| ANT2+ | O | RS-422 (2 V to 4 V diff.) | 18 | X10 |
| ANT3- | O | RS-422 (2 V to 4 V diff.) | 19 | X10 |
| ANT4- | O | RS-422 (2 V to 4 V diff.) | 20 | X10 |
| ANT2- | O | RS-422 (2 V to 4 V diff.) | 21 | X10 |
| ANT1- | O | RS-422 (2 V to 4 V diff.) | 22 | X10 |
| not used | | | 23 | X10 |

| Designation | In/ Out | | PIN No. | Connector |
|-------------|------------|--|------------|-----------|
| not used | | | 24 | X10 |
| not used | | | 25 | X10 |

ANT COMM. IN/OUT X50

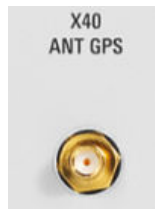
N-type female 50 Ω



| Designation | In/ Out | | PIN No. | Connector |
|------------------|------------|---------------------|------------|-----------|
| ANT COMM. IN/OUT | | GSM/UMTS/LTE / 50 Ω | | X50 |

ANT GPS X40

Female panel mount connector SMA



| Designation | In/ Out | | PIN No. | Connector |
|-------------|------------|-------------------------|------------|-----------|
| RF IN | I | GPS signal from antenna | | X40 |

AUX IN/OUT X30

7 PIN GS female



Table 5-1: Standard pinout

| Designation | In/Out | | PIN No. | Connector |
|-------------|--------|-------------------------|---------|-----------|
| ALARM1 | O | +5V_STBY GND = L (Psoc) | 1 | X30 |
| ALARM2 | O | +5V_STBY GND = L (Psoc) | 2 | X30 |
| ALARM3 | O | +5V_STBY GND = L (Psoc) | 3 | X30 |
| GND | B | GND | 4 | X30 |
| PT100_SENSE | I | 0 °C = 1.1 V 4.29 mV/K | 5 | X30 |
| AGND | B | GND | 6 | X30 |
| not used | | | | |

Table 5-2: Alternative pinout: Service connection to internal router

| Designation | In/Out | | PIN No. | Connector |
|-------------|--------|--|---------|-----------|
| Switch | I | | 1 | X30 |
| Switch | I | | 2 | X30 |
| LED + | O | | 3 | X30 |
| LED - | O | | 4 | X30 |
| not used | | | 5 | X30 |
| not used | | | 6 | X30 |
| not used | | | 7 | X30 |

ETHERNET-WAN X20

RJ45 female



| Designation | In/ Out | | PIN No. | Connector |
|-------------|------------|--|------------|-----------|
| TD0+ | B | | 1 | X20 |
| TD0- | B | | 2 | X20 |
| TD1+ | B | | 3 | X20 |
| TD2+ | B | | 4 | X20 |
| TD2- | B | | 5 | X20 |
| TD1- | B | | 6 | X20 |
| TD3+ | B | | 7 | X20 |
| TD3- | B | | 8 | X20 |

ETHERNET-LAN X21

RJ45 female



| Designation | In/ Out | | PIN No. | Connector |
|-------------|------------|--|------------|-----------|
| TD0+ | B | | 1 | X21 |
| TD0- | B | | 2 | X21 |
| TD1+ | B | | 3 | X21 |
| TD2+ | B | | 4 | X21 |
| TD2- | B | | 5 | X21 |
| TD1- | B | | 6 | X21 |

| Designation | In/ Out | | PIN No. | Connector |
|-------------|------------|--|------------|-----------|
| TD3+ | B | | 7 | X21 |
| TD3- | B | | 8 | X21 |

Index

A

| | |
|--------------------------------|--------|
| Accessories | |
| Recommended | 16 |
| Supplied | 16 |
| Antenna selection switch | 12, 32 |
| Antenna switch | 32 |
| Antennas | 31, 34 |

B

| | |
|----------------------|----|
| Block diagrams | 70 |
|----------------------|----|

C

| | |
|-----------------------------------|----|
| Cabling | 23 |
| Checking | |
| 3/4G wireless module | 62 |
| Device fuses | 67 |
| Ethernet interface | 59 |
| Internal operating voltages | 56 |
| LEDs | 65 |
| Receiver | 59 |
| Router | 60 |
| System components | 56 |
| System computer | 58 |
| Configuration | |
| Loading | 55 |
| Modifying | 54 |
| Reset | 55 |
| Connectors | |
| Chassis | 22 |

D

| | |
|--|----|
| DC feed | 12 |
| Description of the individual components | 9 |
| Design | 8 |
| DIAGnostic subsystem | 40 |
| Direction finder | 11 |

E

| | |
|------------------------------|----|
| Equipment supplied | 16 |
| Ethernet LAN interface | 24 |
| Ethernet WAN interface | 26 |

F

| | |
|-----------------------|----|
| Firmware update | 53 |
|-----------------------|----|

G

| | |
|--------------------|----|
| GPS receiver | 10 |
| Grounding | 23 |

I

| | |
|-----------------------------|--------|
| Inserting a SIM card | 33 |
| Installation | 18, 19 |
| Interface description | 70 |
| Introduction | 7 |

K

| | |
|--------------------------------|----|
| Keyboard, mouse, monitor | 44 |
|--------------------------------|----|

L

| | |
|-----------------------|----|
| Local operation | 36 |
|-----------------------|----|

M

| | |
|--------------------------|----|
| Maintenance | 43 |
| Microcontroller | |
| Resetting | 68 |
| Mounting on a mast | 19 |
| Mounting on a wall | 20 |

O

| | |
|-----------------------------------|----|
| Opening | 64 |
| Operation | 35 |
| Operation via SCPI commands | 39 |
| Ordering information | 17 |

P

| | |
|---------------------------|--------|
| Power supply | 10, 23 |
| Preparation for use | 18 |

R

| | |
|------------------------------|--------|
| R&S Argus | 39 |
| Receiver | 9 |
| Remote Desktop | 38 |
| Remote operation | 36 |
| RJ45 connector housing | 30 |
| Router | 11, 51 |

S

| | |
|------------------------------|--------|
| SCPI commands | 39 |
| Selecting the location | 18 |
| Specifications | 15 |
| SWITch subsystem | 41 |
| Switch-on | 35 |
| System computer | 10, 43 |
| System overview | 21 |

T

| | |
|---------------------------|----|
| Temperature control | 11 |
|---------------------------|----|

U

| | |
|------------------------------|----|
| Unpacking and checking | 18 |
| Update | |
| R&S UMS300 application | 45 |
| Receiver firmware | 47 |

V

| | |
|--------------------------|----|
| Voltage control | 11 |
| Voltage monitoring | 10 |

W

| | |
|------------------------------|----|
| Winbox | 51 |
| Windows Remote Desktop | 43 |
| Wireless module | 11 |

X

| | |
|---------------|----|
| X20 WAN | 26 |
| X21 LAN | 24 |