# R&S® SpycerBox Ultra TL Storage Solution

## User Manual

2902.2082.02

ROHDE&SCHWARZ

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|---|---|
| **Document** | User Manual |
| **Product** | SpycerBox Ultra TL |
| **Revision** | Version 2.0 |
| **Material Number** | 2902.2082.02 |
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# Contents

# Introduction

This documentation describes how to use the hardware of SpycerBox Ultra TL, the storage solution by Rohde & Schwarz.

# Target Group

To use this manual you should know how to handle computer equipment. Furthermore, to connect the R&S system to a network or a SAN storage you should have experience as a network administrator and know how to set up the required network connections on the installation site in hard- as well as software.

When performing maintenance tasks on the hardware of the R&S system, you must be qualified to work on, repair and test electrical equipment.

# Conventions Used in this Guide

Important subjects in the user guide are particularly emphasized.

### Representation Conventions

1. Texts preceded by this symbol describe a sequence of activities that you must perform in the order indicated.

- Texts preceded by this symbol describe a single step action.
  - ▸ Texts preceded by this symbol describe the result of an action.
- Texts preceded by this symbol are parts of a list.
- ☑ Texts preceded by this symbol are parts of a requirements list.

| | |
|---|---|
| **WINDOW** | Text in small caps indicates a labeled items of the user interface such as window name. |
| **BUTTON** | Text in small caps and bold indicates a push button. |
| ***Menu > Option*** | In the specified group or menu select the stated item. |
| `Directory/File` | Directory structure or file |
| `Entry` | Indicates parameters or variables, as well as selections or entries made in a program; it may also indicate a command (e.g. at a command line), a syntax or contents of a file/output. |
| **[Key]** | An individual key or a key combination on a keyboard |

> Texts preceded by this symbol are general notes intended to facilitate work and help avoid errors.

## Keyboard Shortcuts

Performing options or procedures with the keyboard often requires a simultaneous pressing of two keys.

**Examples:**

| | |
|---|---|
| **[Ctrl + F1]** | If this is given, hold down the [Ctrl] key and press simultaneously the [F1] key. |
| **[Alt, F1]** | If this is given, press the [Alt] key first and then the key [F1] successively. |

## Screenshots

The screenshots shown in this documentation may be taken on various operating systems as well as from pre-release versions of the software. Their appearance may differ from your environment. However, they should contain all relevant elements that you need to understand the described actions.

# Appropriate Use

This topic describes the appropriate use of the system:

It contains the following sections:

## General

To use the SpycerBox Ultra TL correctly please heed the following:

| | |
|---|---|
| **NOTICE** | **Inappropriate use** |
| | If the R&S system is not used in compliance with the safety instructions, the warranty and all resulting liability claims will be void. |
| | **Carefully read the following safety instructions before attempting any installation and/or performing any work on the system hardware**. |

SpycerBox Ultra TL has been built according to the applying safety regulations. To minimize the possibility of a faulty operation of the device all manuals and guides must be available at all times at the operation site. Before installing and/or using the R&S system the manuals and guides delivered with it must be read and observed:

- Use the R&S system only in apparent good technical order.
- The hardware of the R&S system works with voltages that can be hazardous to your health. Never work on the system or access its interior with the power cable(s) being plugged in. Make sure the power supply is disconnected from the components you intend to work on.

■ Computer hardware contains components that are sensitive to electrostatic discharge. If you touch them without precautionary measures, they can be destroyed. Use a wrist strap connected to ground when accessing electronic parts and take care of grounding the system. Avoid touching the internal components of the R&S system whenever possible.

■ Computer hardware contains components that are sensitive to changing voltages. Connecting or disconnecting the R&S system to or from peripheral hardware while any of them is switched on may damage the hardware. Switch off all peripheral hardware before connecting or disconnecting anything.

■ Use, store and transport the R&S system only in compliance with the technical data laid out in chapter "Appendix" (page 71).

■ If fluids or solid objects get inside the casing, the R&S system must be disconnected from the power supply immediately. Before using the system again, it has to be checked by authorized service personnel.

■ Only use a damp tissue without any cleaning agents to clean the casing.

■ The R&S system must not be misused, abused, physically damaged, neglected, exposed to fire, water or excessive changes in the climate or temperature, or operated outside maximum rating.

■ Do not perform any changes or extensions to the R&S system whatsoever.

### Transportation

SpycerBox Ultra TL is a very sensitive device. Especially the disks of the system must be handled with great care. Therefore, observe in case of transportation:

■ Handle the R&S system with great care.

■ Always use the original packing or a similar structured packing for transportation as detailed in section "Packing Instructions" on page 78.

■ Avoid shocks or vibrations during transport. For longer distances it is recommended to use a lifting truck.

■ Keep the R&S system as a transportation good dry.

■ In the warranty period you have to keep the original packing and use it in case of transportation.

## Environmental Conditions

For error-free working and a long service life SpycerBox Ultra TL needs some basic environmental conditions:

■ Do not expose the R&S system to sources of heat, such as direct sunlight or a radiator.

■ Do not cover or obstruct the ventilation holes of the system.

■ When installing the R&S system in a rack, take care that warmed up air is conducted to the rear of the rack and properly vented away.

■ Avoid areas with high humidity or dust. Best operating conditions are given in an air-conditioned site.

■ Do not expose the R&S system to strong electric or magnetic fields.

■ Avoid areas where the R&S system will be subject to vibrations or shocks.

# Important Notes

The following provides information about warranty, a note about the conformity of the product and some other general information

## Warranty Information

This product is warranted to be free of defects in materials and workmanship for a period of one year from the date of purchase. Rohde & Schwarz extends this Limited Warranty to the original purchaser.

| NOTICE | **Incorrect packaging** |
|---|---|
| | This warranty will be void if you do not transport the R&S device in the original packing. |
| | **You have to keep the original packing and use it in case of transportation. The drives must always be packed separately.** |

In the event of a defect or failure to confirm to this Limited Warranty, Rohde & Schwarz DVS GmbH will repair or replace the product without charge. In order to make a claim under this Limited Warranty, the purchaser must notify Rohde & Schwarz DVS GmbH or their representative in writing of the product failure. In this Limited Warranty the customer must upon Rohde & Schwarz DVS GmbH request return the product to the place of purchase or send the defective device to a given address for the necessary repairs to be performed. In the warranty period the customer must keep the original packing and pack the R&S product in it in case of a product return. If the customer is not satisfied with the repair, Rohde & Schwarz DVS GmbH will have the option to either attempt a further repair, exchange the product or refund the purchase price.

The warranty does not cover:

- Products not developed by Rohde & Schwarz DVS GmbH.
- Products not used in compliance with the safety instructions detailed in section"Appropriate Use"  (page 9).
- Products on which warranty stickers or product serial numbers have been removed, altered or rendered illegible.

- The costs of installations, removals, transportations, or re-installations.

- Costs for transportation damages.

- Damages caused to any other item.

- Any special, indirect or consequential damages, and damages resulting from loss of use, data or profits, or business interruption.

## Declaration of Conformity

This product has been tested according to the applying national and international directives and regulations.

## Product Disposal (B2B)

Used electrical and electronic products should not be disposed of with general household waste. At the end of its service life you may return the R&S product after appropriate prior notification to either your local distributor or Rohde & Schwarz DVS GmbH in Germany. Rohde & Schwarz DVS GmbH will then take the device free of charge to a waste disposal organization which will recycle and reuse it environmental friendly.

## General Notes

Please observe the following general important notes:

| **NOTICE** | **Storage capacity exceeded** |
|---|---|
| | In case of a full storage performance losses may occur. |
| | **Leave about 20% of the overall main storage capacity empty of data for performance reasons.** |

**NOTICE** **Operating system updates and security patches**

R&S provides only tested and certified updates and security patches which will be delivered after the official release of the update or, in case of incompatibility, will not be delivered at all.

Installing uncertified operating system updates and security patches may have a negative impact on the system's performance.

**Performing OS updates and installing security patches, which are not certified by the R&S is done at your own risk. It is the customer's responsibility to provide for a secured network.**

**NOTICE** **Installation of third-party software**

Your R&S system has been tested thoroughly and is very reliable. However, because of the vast amount of third-party software available, its reactions on the installation of such could not be tested. The installation of third-party software may disrupt the real-time capability and/or limit the functionality of your system.

**When installing third-party software, make sure that it does not interrupt and/or limit any functionality of the system.**

# Overview

The SpycerBox Ultra TL provides high-performance nearline storage for mid-term archive including the support of all uncompressed and compressed formats up to 4K. Furthermore, you can monitor the whole infrastructure or perform an easy maintenance due to a modular backplane tray design.

This chapter is divided into following sections:

# Variants

The SpycerBox Ultra TL can be delivered in two different hardware variants depending on, for example, the amount of the storage or the performance that is required. The following variants are available:

- Half: SpycerBox Ultra TL using 24x3.5" SATA (enterprise) hard disks and providing a storage capacity of up to 144 TB

- Full: SpycerBox Ultra TL using 48x3.5" SATA (enterprise) hard disks for up to 288 TB of storage capacity

- JBOD: SpycerBox Ultra TL using 48x3.5" SATA (enterprise) hard disks for up to 384 TB of storage capacity
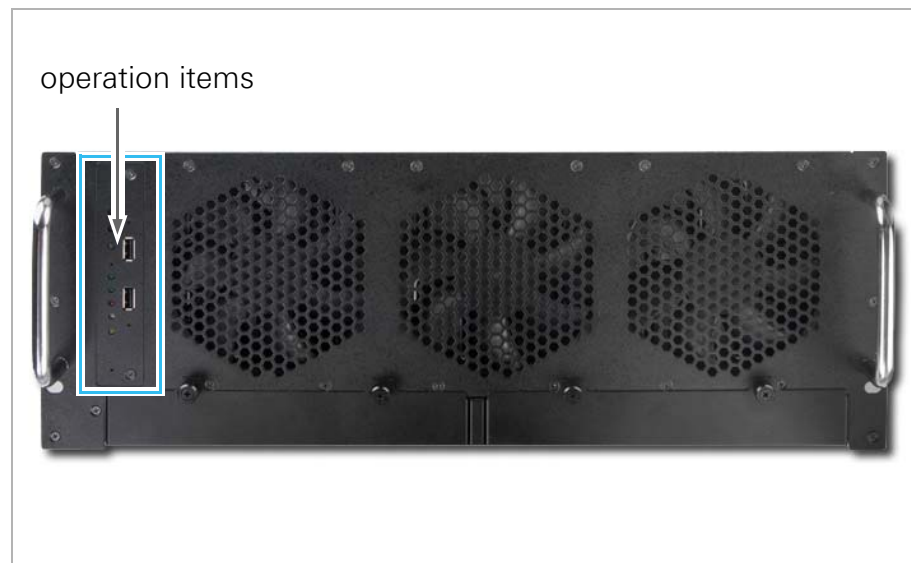
# Overview of the Front

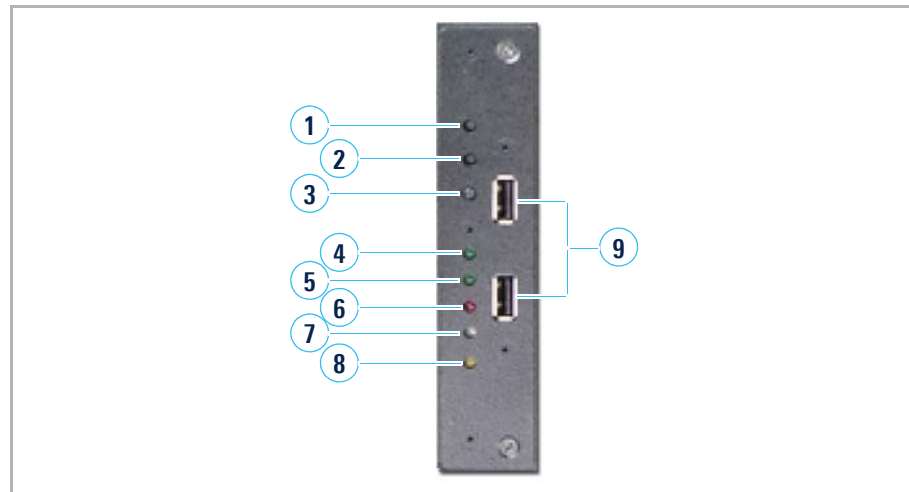This section provides an overview of the front of the system.
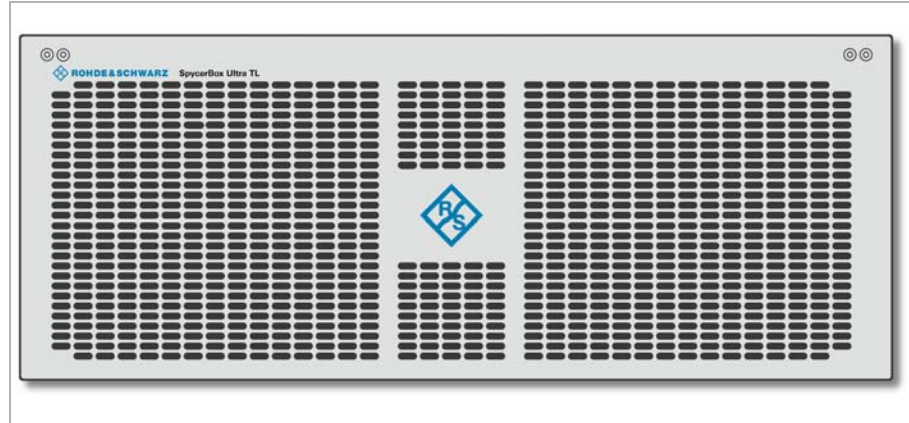


Overview of the front with a front cover

The front of the system is equipped with a removable front cover to protect the three main cooling fans on the front plate and provide sufficient air circulation.



operation items

Overview of the front without a front cover

With the operation items at the system's front the hardware of the SpycerBox Ultra TL can be controlled (e.g. turned on or off). There you can also find LEDs that allow you to assess the state of the R&S system as well as USB connectors.

Operation items overview

| No. | Item | Explanation |
|---|---|---|
| 1 | mute | In case of a hardware malfunction a system alarm turns on. By pressing this button the alarm buzzer can be switched mute. Use a thin, pointed object to press this button. |
| | | **ℹ** Some alarms (e.g. the one in case of a disk failure) are independent of the system alarm and cannot be switched mute with the mute button. |
| 2 | reset | Resets your system and initiates a reboot. Use a thin, pointed object to press this button. |
| | | Data loss<br>**NOTICE** When resetting the system without having saved data, data may get lost. Save your data before resetting the system. |
| 3 | power | The power switch turns the system on or off. |
| 4 | LAN 1 | Indicates the presence of network connection on port LAN 1. |
| 5 | LAN 2 | Indicates the presence of network connection on port LAN 2. |
| 6 | alarm | Indicates alarm in case of hardware malfunction, please contact R&S service team. |
| 7 | power status | Indicates that the system is powered on. |

| No. | Item | Explanation |
|-----|------|-------------|
| 8 | - | Disabled |
| 9 | USB ports | USB 2.0 input |

> **i** Lift the faceplate to have a better overview on the LEDs and estimate the current state of the system, see section "Lifting the Faceplate" (page 40).
>
> Further information about what to do in case of an alarm can be found in section "Troubleshooting" (page 72)

# Hard Disk Array

This section provides an overview of the system's interior.

The hard disks of the storage hard disk array are used, for example, to store proxy clips of your video and audio material or backup files of the connected central storage. It is the main storage of the R&S system. To prevent data loss in case a hard disk fails, it is normally RAID protected.

| | |
|---|---|
| **i** | Further information about RAID can be found in section "Introduction to RAID"  (page 48). |
| | The system disks (SSD) are not among the hard disks of the hard disk array. They can be found in the system disk array, see section "System Disk Array"  (page 22). |

Once the top cover is lifted, you have access to the hard disk array:

Left disk set

Right disk set

Operation items overview

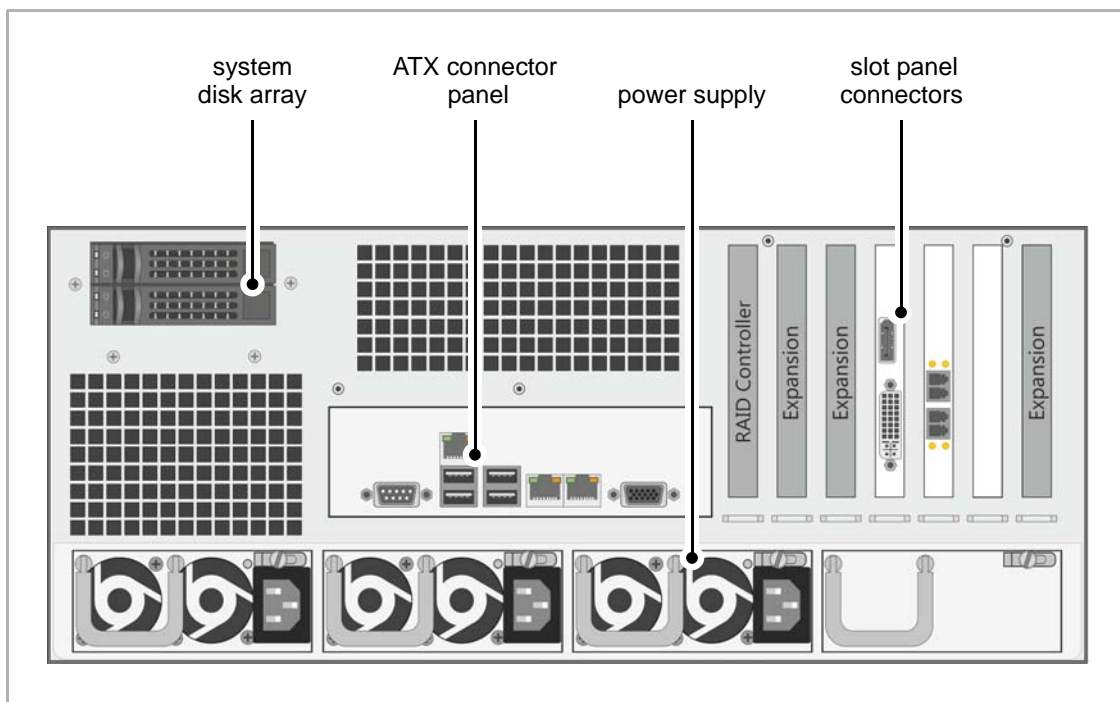| | |
|---|---|
| **i** | At shipment, the hard disks are delivered separately and therefore have to be installed before putting the system into operation, see section "Installing the Hard Disks"  (page 34). |

# Overview of the Rear

This section provides an overview of the rear of the system:.

The following topics are covered:

- The Rear of the System  (page 21)
- System Disk Array  (page 22)
- ATX Connector Panel  (page 24)
- Power Supply  (page 25)
- Slot Panel Connectors  (page 27)

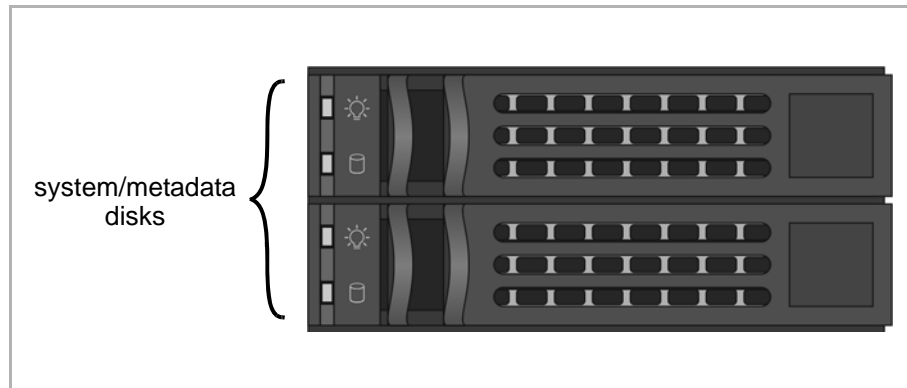## The Rear of the System



Rear view

| | |
|---|---|
| **system disk array** | The system disk array contains the SSDs for the operating system and metadata. You can find further information about this in section "System Disk Array" (page 22). |
| **ATX connector panel** | On this panel you can find the standard connectors of the computer system. Further information about them can be found in section "ATX Connector Panel" (page 24). |
| **power supply** | The redundant power supply provides the system with power. It consists of several independent power supply units: Even if one fails the others will still supply enough power to keep the system operational. Further information about the power supply can be found in section "Power Supply"  (page 25). |
| **slot panel connectors** | The slot panel connectors of the R&S system provide, for example, the network connections to connect the system to a SAN. Furthermore, if applicable, some additional panels may be present for internal reasons or on customer request. More details about the slot panel connectors can be found in section "Slot Panel Connectors"  (page 27). |

## System Disk Array

The system disk array at the rear of the system contains SSDs for the operating system and metadata. To prevent data loss in case a disk fails, they are normally RAID protected. Furthermore, these disks are protected with a cache protection unit to prevent data loss, for instance, in case of a power failure.

> More information about RAID can be found in section "Introduction to RAID"  (page 48). The backup unit is described in section "Cache Protection Unit" (page 29).

System disk array

The system SSDs are connected to the system with the help of disk carriers which make the removal of a disk easy, for example, in the event of a failure.

> The hard disk array of the storage and the system SSDs are mounted using different carriers. Thus, they are installed differently into the system.
>
> Further information about how to remove and exchange a SSD can be found in section "Disk Maintenance" (page 48).

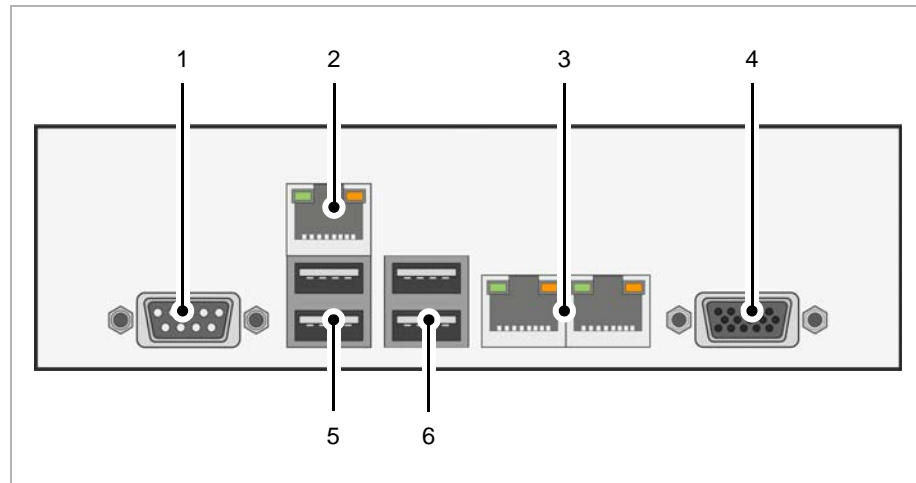---

**NOTICE**

**Disk fail in the same RAID array**

Storage disk array: If a third disk within the same disk set fails in the meantime, the data will be unrecoverable.

System disk array: If the second disk fails in the meantime, the data will be unrecoverable.

**Replace a broken disk immediately.**

## ATX Connector Panel

The ATX connector panel on the rear of the R&S system holds the connectors of the computer system. It provides the following connections:



ATX connector panel on rear

| No | Item | Description |
|---|---|---|
| 1 | COM port | RS232 connector for the connection of serial interface devices. |
| 2 | IPMI | Dedicated LAN port for IPMI 2.0 (Intelligent Platform Management Interface) providing KVM (Keyboard, Video, Mouse redirection) as well; for further information see the documentation(s) of the original manufacturer(s). |
| 3 | LAN (10 Gb) | 10 Gb Ethernet Copper (10000BASE-T) connection ports to connect the system to a network. |
| 4 | VGA | DB-15 connector (female) to connect a monitor. Normally with an extra graphics card installed, this connector will not be operational; however, to use IPMI/KVM for system management it has to be made operational again; if you want to use IPMI/KVM, please contact R&S in case of setup questions. |

| No | Item | Description |
|----|------|-------------|
| 5 | USB port 2.0 | These USB connectors offer you the possi-bility to connect other devices to your system. |
| 6 | USB port 3.0 | |

## Power Supply

The redundant power supply provides the system with power. It consists of several independent power supply units: Even if one fails the others will still offer enough power to keep the system working.

| **NOTICE** | **Second power supply failure** |
|---|---|
| | The system can be operated with one power supply unit out of order. However, if another one fails, a continued operation of the system cannot be guaranteed. |
| | **Change a failed power supply unit immediately (see section "Power Supply Maintenance" on page 61).** |

| **i** | The state of the power supply units can be easily checked either with their LEDs as explained below or with the general alarm LED, see "Overview of the Front"  (page 17). |
|---|---|

The following provides an overview of one of the power supply units:
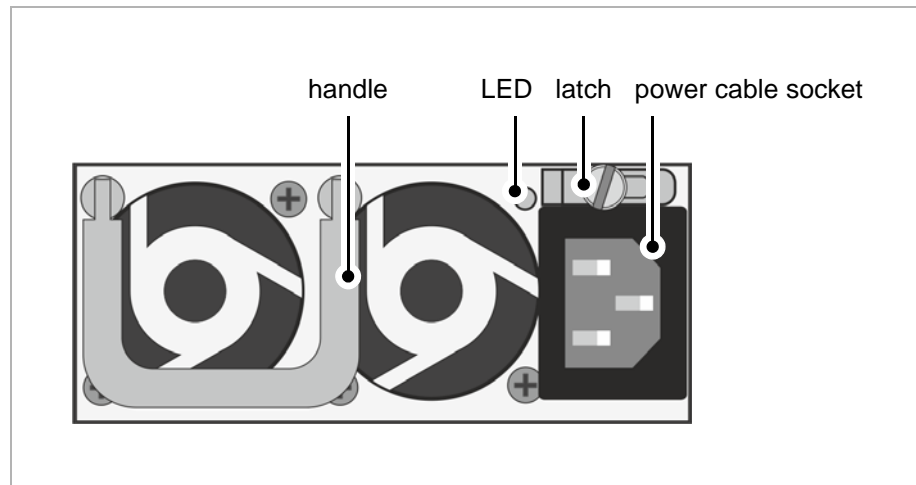
Overview of the power supply unit

**Power supply unit**

| | |
|---|---|
| **handle** | With the handle of the power supply unit you can pull the unit out of the power supply once it is unlocked with the latch. |
| **LED** | The LED indicates the state of the power supply unit:<br>■ green: normal operation<br>■ off: standby mode<br>■ off (alarm LED on): disconnected from power or malfunction |
| **latch** | The latch of a power supply unit locks it in the power supply. By pressing it toward the handle the unit can be unlocked and pulled out of the power supply with the help of the handle. |
| **power cable socket** | The socket where the power cable has to be plugged in to provide the system with power. |

To pull out a power supply unit you have to remove the security bar of the power supply first (see section "Power Supply Maintenance" on page 61).

## Slot Panel Connectors
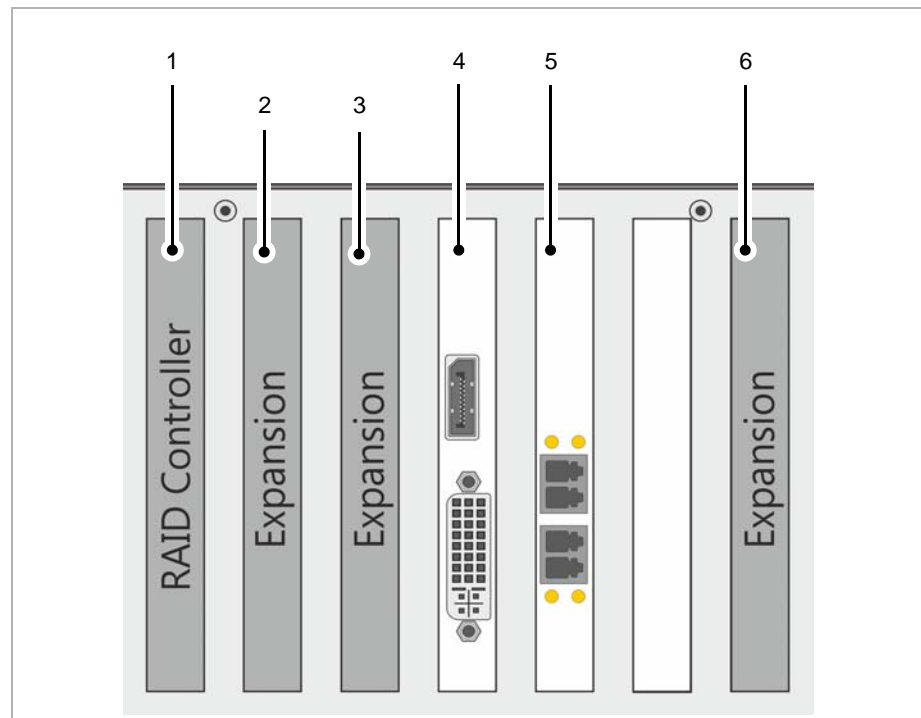


Example of a slot panel configuration on the SpycerBox Ultra TL

| No. | Item | Explanation |
|-----|------|-------------|
| **1** | RAID controller | Manages the hard disks of the storage array. |
| **2** | Expansion slot | Expansion slot for a second RAID controller |
| **3** | Expansion slot | Can be extended with one of the following options:<br>■ dual-port 10 Gigabit Ethernet interface for data mirroring<br>■ quad-port 10 Gigabit Ethernet interface for the High Availability Option.<br>■ single-port 40 Gigabit Ethernet interface<br>■ dual-port 40 Gigabit Ethernet interface |
| **4** | Graphics card | Provides a DVI-I and a DisplayPort to connect a monitor to. |

| No. | Item | Explanation |
|---|---|---|
| **5** | Dual-port Fibre Channel / Expansion slot | Can be extended with a quad-port Fibre Channel. |
| **6** | Expansion slot | Can be extended with a quad-port 1 Gigabit Network Interface Card (NIC). |

The above layout of the slot panel area is just an example. The one at your system may differ from the figure above: The position of the individual slot panels may vary and/or other panels may be installed, either for internal reasons or on your request. The slot panels showing **Expansion** in the figures above represent empty slot panels for optional cards that you can order.

Note that systems with JBOD configuration do not have any slot panels on the back, except for a single USB connection for monitoring purposes.

# Cache Protection Unit

To prevent data loss especially for the metadata, the system provides a zero-maintenance flash-based unit for cache protection. It features a flash memory and capacitor technology that save cached data if a system power loss occurs. The capacitor charges automatically while the system is booting to provide instant cache protection upon startup, and is fully charged in a few minutes.

The cache protection unit is located inside the casing under the system disk array.
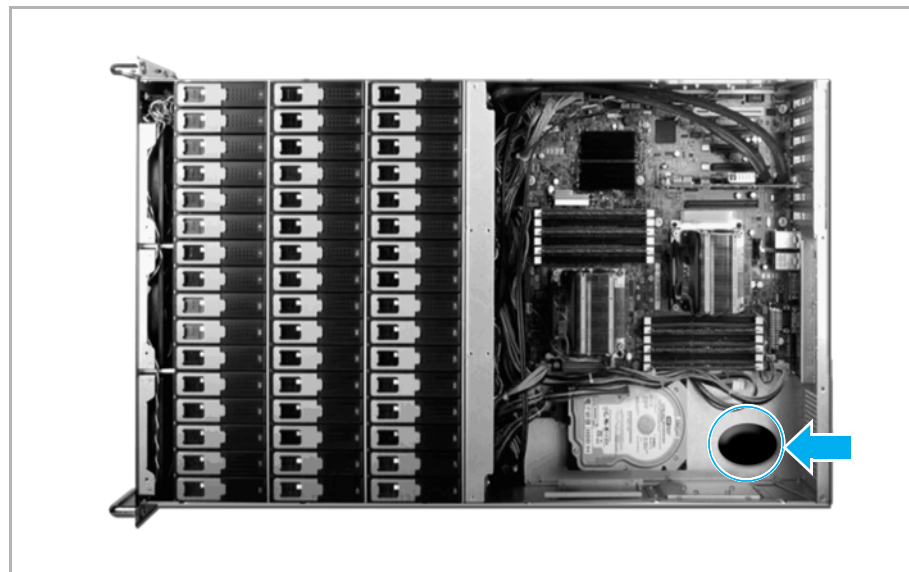


If the system's operation gets interrupted, for example, in case of a power failure, it will provide power to the cache of the connected RAID controller, so that buffered data will not get lost. Once the operation of the system is restored, the cached data will be written to the disks.

# Installation

This chapter describes the installation of the SpycerBox Ultra TL hardware. The system must be installed properly before you can start working with it.

This chapter is divided into the following topics:

- Preparations  (page 32)
- Opening the Casing  (page 33)
- Installing the Hard Disks  (page 34)
- Closing the Casing  (page 36)
- System Setup  (page 37)
- Note about the Network Installation  (page 38)

# Preparations

Perform the following steps:

1. Unpack the R&S system and its accessories.

2. Check your delivery and compare it with the delivery note included in the package on an extra sheet of paper. In case of missing items, please contact your local vendor or Rohde &Schwarz immediately.

| **NOTICE** | **Warranty Claims** |
|---|---|
| | **To make warranty claims you have to keep the original packing and use it in case of a return transportation** |

3. Place the system on a firm, flat surface within reach of a power outlet or mount it in a rack. For proper air circulation and cooling make sure the ventilation holes are not covered.

The system is now prepared for installation.

# Opening the Casing

Perform the following steps:

| ⚠ **DANGER** | **High Voltage** |
|---|---|
| | The system you are working on operates with voltages that can be hazardous to your health. |
| | **Never work on the system or access its interior with the power cable(s) being plugged in. Make sure the power supply is disconnected from the components you intend to work with.** |

> ℹ The system must be operated only with the chassis' cover installed to ensure proper cooling.

1. Disconnect all power cords from the system.

2. Unscrew the eight screws to detach the two covers. Slide both covers backwards and remove them.
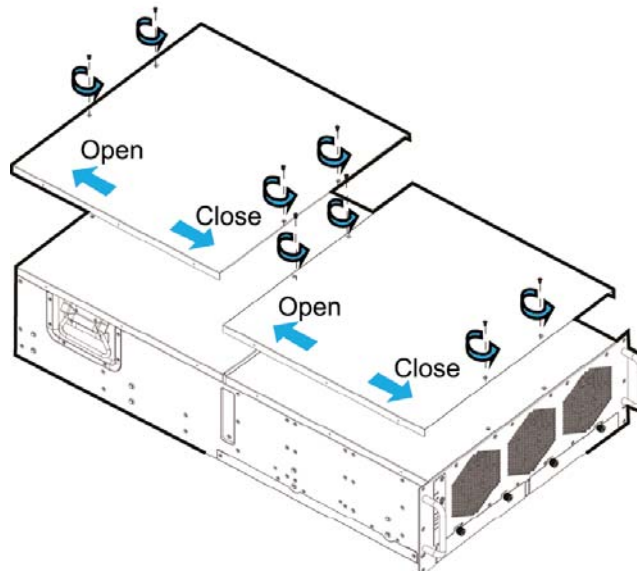
# Installing the Hard Disks

The hard disks are delivered in a separate packing and have to be installed prior to using the system.

> Each hard disk is labeled with its exact position within the array. There are two hard disk sets, one each for the left and the right side.
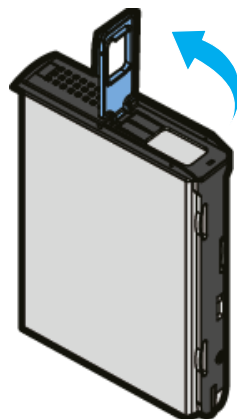
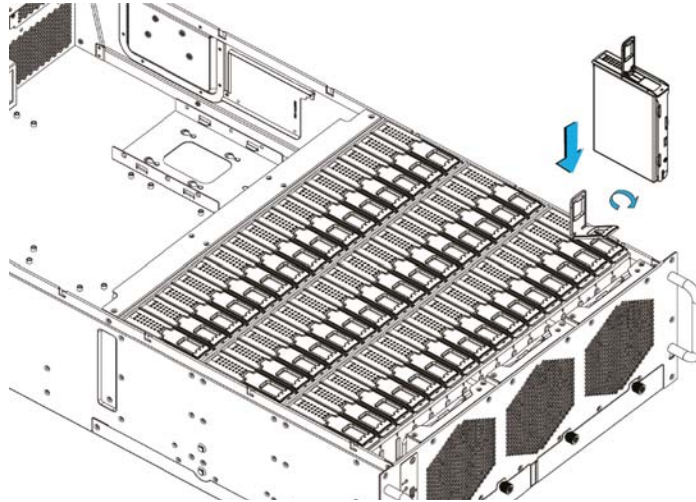The disk assignment is as follows:
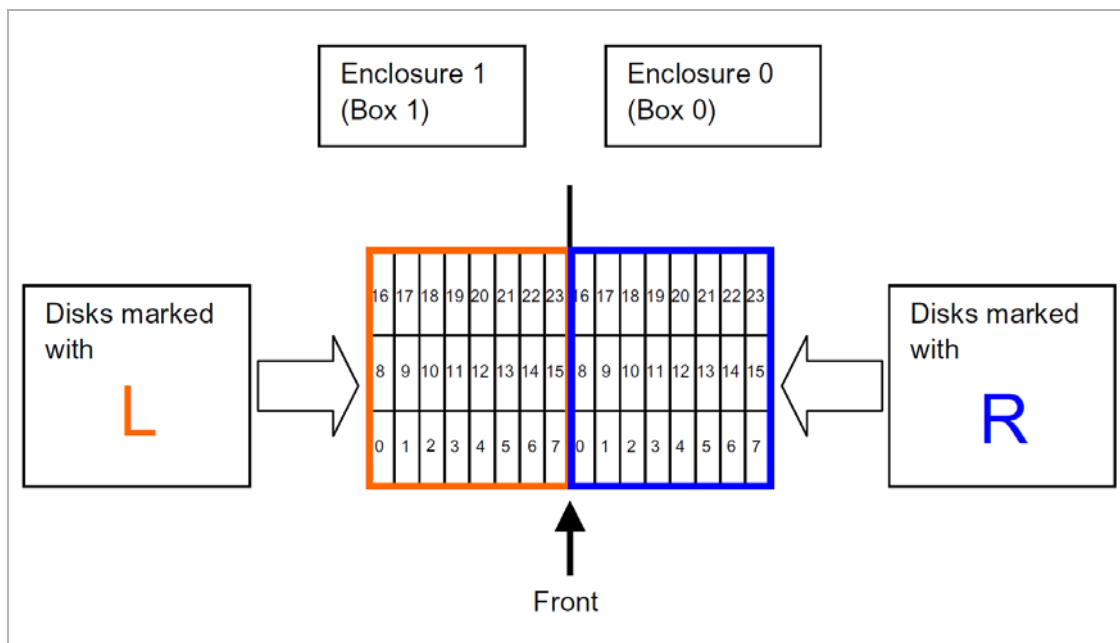


Assignment of the hard disks

Perform the following steps:

1. Unlatch the disk carrier of the hard disk by pulling up the opener of the disk carrier.

2. Carefully place the carrier from above and close the handle to mount the HDD. Observe the correct hard disk assignment.
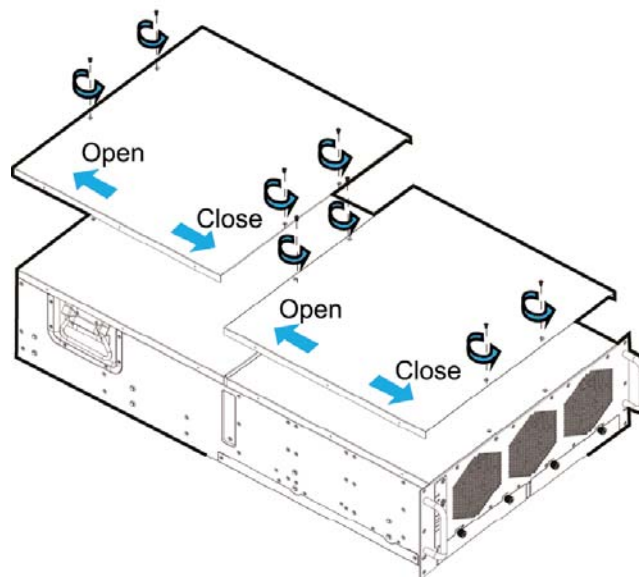
# Closing the Casing

After finishing your task at hand you have to close the casing of the R&S system again.

Perform the following steps:

1. Put the covers back on and slide them into place until they lock.

2. Fasten the eight screws.



With this the task of closing the casing is finished and you can turn the system back on at any time.

# System Setup

This section describes the setup of the SpycerBox Ultra TL hardware. The system must be installed properly before you can start working with it.

Perform the following steps:

1. Connect at least the following computer peripherals:
   ➜ Mouse,
   ➜ Keyboard and
   ➜ a monitor that is operable at a resolution of at least 1280 × 1024 pixels (default manufacturing setting).

2. Connect any other peripheral computer equipment. For an overview of the panels and connectors at the system's rear, see section "The Rear of the System" (page 21).

3. Connect the power cable(s) to the system.

The SpycerBox Ultra TL hardware is now properly installed and you can switch on the system as described in section "Starting the System".

# Note about the Network Installation

Because of the amount of possible workflows that customer's may use the SpycerBox Ultra TL for as well as network connections (see "Slot Panel Connectors" (page 27)), this document does not describe how to connect the R&S system to a network or central storage.

To connect the R&S system to a network/central storage you should have experience as a network administrator and know how to set up the required network connections on the installation site in hard- as well as software. In case you experience difficulties during the installation, R&S offers you special assistance that will be tailored to your personal needs and which can range from remote diagnosis to on-site services. Please contact the R&S service department for further information.

# Operation

This chapter describes how to operate the SpycerBox Ultra TL hardware, i.e. it is explained how to start the system and how to shut it down. For both procedures you have to use the power switch of the operation items at the front of the system.

Additionally, the configuration management software SAN Remo is described briefly which allows you to configure, reboot and shut down the SpycerBox Ultra TL..

This chapter is divided into the following topics:

- Lifting the Faceplate  (page 40)
- Starting the System  (page 41)
- R&S®SAN Remo  (page 42)
- Shutting Down the System  (page 44)

# Lifting the Faceplate

The faceplate of the system can be lifted to access the operation items.

Perform the following steps:

1. When in front of the system lift the lower edge of the plate up towards you. Now the operation items panel is accessible.
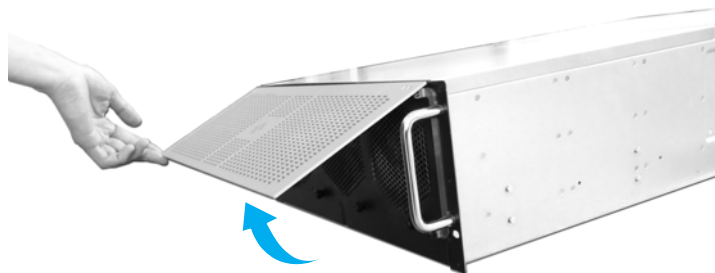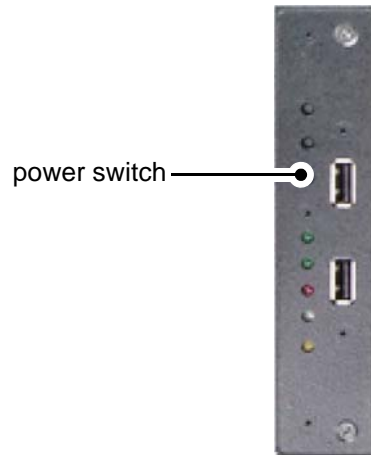


> **i** To close the faceplate reverse the above step.

# Starting the System

After a proper installation of the system you may start the R&S system at any time.

Perform the following steps:

• Press the power switch briefly to turn on the system.



power switch

▸ As with any standard computer after initial booting, the system begins to load the installed operating system.

During the start-up of the system several alarm beeps will be sounded. This is part of a self-test and does not indicate an error or malfunction.

When the operating system has finished loading, you can begin to work with the R&S system right away.

# R&S®SAN Remo

R&S configuration management software SAN Remo can be used to configure, reboot and shut down the SpycerBox Ultra TL.

SAN Remo will run in the web browser (Mozilla Firefox version 4 and higher, Internet Explorer version 11 and higher, Google Chrome and Safari) on every client in the network. The address is either the localhost (`127.0.0.1`) or the IP address of the SpycerBox Ultra TL in the network. After starting it, you have to enter a user name (default: `admin`) and password (default: `admin`).
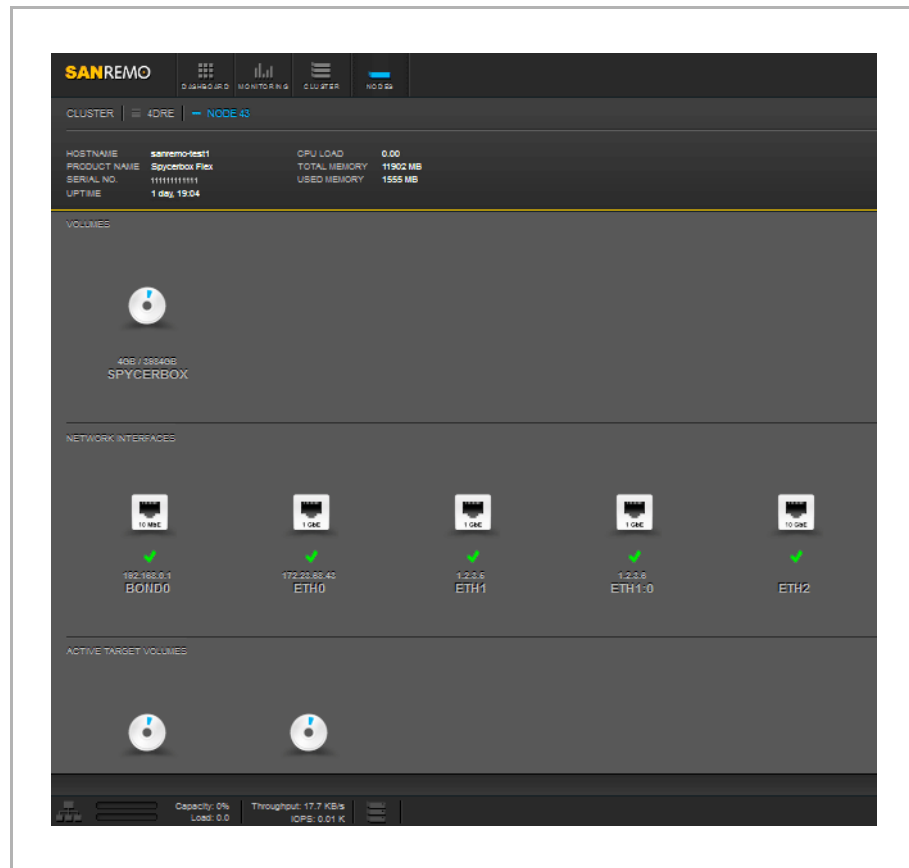


Plugin view in the SAN Remo software

With SAN Remo you can change the configurations of the R&S system (e.g. its IP address or Fibre Channel connections). Select the system represented by a node and click on the respective icon to view and change the settings. Afterwards you will see all options that can be changed. With the monitoring feature you can obtain a graphical overview of certain properties of different nodes.

SAN Remo can also be used to gather log files of the system, for example, for troubleshooting. By default they will be saved in a single archive file on the desktop of your system.

Additionally, you can reboot or shut down the R&S system with SAN Remo.

For a complete description of the features of SAN Remo and how to use it refer to the "SAN Remo Configuration Management" supplement.

How to use SAN Remo for the SpycerBox High Availability Option is described in the "SpycerBox High Availability Administration Supplement".

# Shutting Down the System

There are several possibilities to shut down the system. It depends on whether the operating system is already loaded, frozen or not completely loaded. Please act accordingly.

## Shut down with operating system fully loaded

If the operating system is up and running, there are two ways to shut down your system.

| | |
|---|---|
| **NOTICE** | **System Damage** |
| | It takes a while to safely erase all memory banks of the system. |
| | **After a shut-down wait at least ten seconds before starting the system again.** |

Perform the following steps:

1. Turn the system off by shutting down the operating system the usual way.
   ‣ The operating system will then save your personal settings and once it has ended, the system will turn off.

2. Alternatively, you can initiate a fast shut down by pressing the power switch briefly.
   ‣ Some settings will be saved and afterwards the system turns off.

| | |
|---|---|
| **NOTICE** | **Data Loss** |
| | The fast shut-down may not save all your system data and personal settings before the system turns off. |

System is shut down.

## Shut down with operating system frozen or not completely loaded

If the operating system is not responding anymore or not completely loaded, do as follows:

**NOTICE** | **Corrupted Data**

Shutting down the system while frozen or not completely loaded may lead to corrupted system data. However, the system should be sufficiently protected against this by the journaling file system and the battery backup unit.

**Use this procedure only if absolutely necessary.**

Perform the following steps:

* Shut down the system by pressing the power switch until the system turns off.

The system will then shut down immediately.

# Maintenance

This chapter explains the maintenance work that you can perform on your own. For each work a detailed procedure description is given. If you experience trouble with the system that cannot be resolved with the work described here, please contact your local vendor or Rohde & Schwarz directly.

This chapter is divided into the following sections:

- Disk Maintenance  (page 48)
- Controller Maintenance  (page 58)
- Power Supply Maintenance  (page 61)
- Backup or Recovery of the System Disk  (page 64)

# Disk Maintenance

This section deals with the possible event of a disk failure.

The following topics are covered:

## Introduction to RAID

In a system where huge amounts of data are processed, large storage capacities combined with high data throughputs are mandatory. To provide both at the same time it is common practice in the area of video and digital film to configure several disks together into a stripe set or RAID. The IT world has defined several 'levels' of RAID, most of them providing some kind of data protection.

The RAID feature makes the R&S system tolerant of disk failures. Even with a broken disk operations can still be continued and, once the failed disk has been replaced, the missing data can be recovered easily. The data protection is provided by RAID controllers installed inside the system. Each controller independently administers the data protection for the set of disks that is connected to it.

The system/metadata disk array comprises two SSDs. They are connected to a RAID controller that applies a RAID 1 to the data, meaning that they are protected by a mirroring of the data between two disks. If one of the SSDs fails, the missing data can be restored with the mirrored information stored on the other disk.

The main storage of the R&S system comprises up to 48 hard disks in the SpycerBox Ultra TL. These are connected to a RAID controller which applies a RAID 6 to the data. With this, the data is striped across these hard disks during write procedures. At the same time the information necessary to rebuild a failed hard disk (parity information) is generated and written

across the disks as well. With the parity information written, two hard disks per disk set (RAID pack) can fail and your data will still be recoverable due to the information stored on the other disks. Optionally, a second controller can be installed to boost performance or to connect a JBOD.
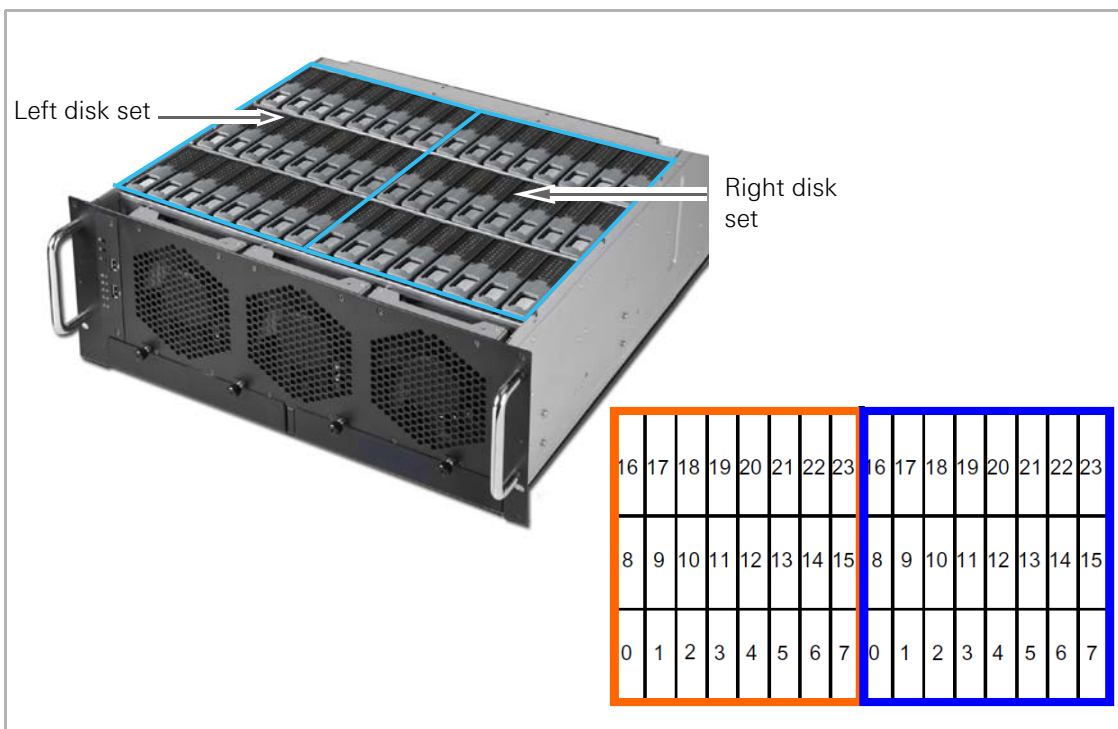
> **NOTICE**
>
> **Disk fail in the same RAID array**
>
> Storage disk array: If a third disk within the same disk set fails in the meantime, the data will be unrecoverable.
>
> System disk array: If the second disk fails in the meantime, the data will be unrecoverable.
>
> **Replace a broken disk immediately.**



Disk sets (RAID packs)

With the available RAID feature the R&S system can withstand disk failures without losing data or access to data.

## Identifying a Defective Disk

In case of an alarm or when suspecting a worn disk, you have to identify the broken disk first in order to replace it.

| NOTICE | **Alarm** |
| --- | --- |
| | An alarm can be caused by a number of reasons. Please refer to section "Troubleshooting" on page 72 first for further details about what to do in case of an alarm. |
| | If a disk fails, the alarm will be sounded by the RAID controller. It cannot be switched mute with the mute button of the operation items. It can be turned off either with the RAID software manager or by replacing the broken disk. |
| | Data accesses to the disk array are still possible because any missing data will be recalculated from the parity information stored on the other disks of the disk set. This can limit the overall performance and real-time operations may no longer be possible. |

| NOTICE | **Disk fail in the same RAID array** |
| --- | --- |
| | Storage disk array: If a third hard disk within the same disk set fails in the meantime, the data will be unrecoverable. |
| | System disk array: If the second SSD fails in the meantime, the data will be unrecoverable. |
| | **Replace a broken disk immediately.** |

| | The hard disk array of the storage and the system SSDs are mounted using different carriers. Thus, they are installed differently into the system. |
| --- | --- |

In most cases you can find the broken disk by simply observing the LEDs of the disk array, see "Hard Disk Array" (page 20).
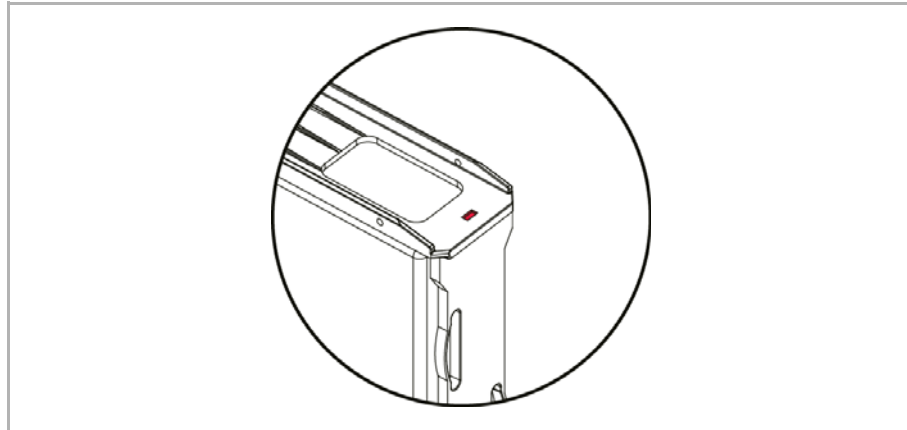
**System Disk Array**  While performing continuous accesses to the data, it will be the one:

- no longer blinking (either continuously on or off),

- irregularly blinking compared to the other SSD disks of the same disk set, or

- showing a SSD disk or disk carrier related error.

**Storage Disk Array**  A red LED on the disk carrier will indicate malfunction.



Alarm LED

| NOTICE | **Wrong disk replaced** |
| --- | --- |
| | Replacing the wrong disk, i.e. a good one instead of the broken one, may result in a total loss of data. |
| | **If you are unsure about having detected the correct disk please contact the R&S service department.** |

## Replacing a System Disk

As soon as the broken SSD disk has been identified (see section "Identifying a Defective Disk" on page 50), it can be replaced easily.

| NOTICE | **Log Files** |
| --- | --- |
| | Before replacing a SSD disk you have to collect the log files of the RAID controller. If you know how to do this you may proceed on your own. If not, please contact the Rohde & Schwarz service department first. |

**Removing the System Disk**

The SSD disks are connected to the system with the help of disk carriers.

For an overview of a disk carrier as well as further information about it see "System Disk Array"  (page 22).

Perform the following steps:

1. If appropriate, stop all accesses to the SSD disk array of your system, for example, by exiting the software and severing the network connections.

2. Unlatch the disk carrier of the defective SSD disk by pressing the opener of the disk carrier (1).



  ▸ This takes the SSD installed in the disk carrier out of the system's interfaces inside.

3. Once the interface connections inside the system are severed, pull the disk carrier out of the system.

Now the SSD is removed from the system and it has to be replaced in the next step.

**Replacing the System Disk**

**NOTICE**   **System Damage**

Significant environmental changes, for example, altitude, voltage, temperature, shock, vibration, etc., can damage a SSD disk.

**Handle SSD disks with great care.**

It is best to use the same brand and type of SSD disk again. Otherwise a loss of performance might occur.

Perform the following steps:

1. Unscrew the screws that fix the SSD disk to the disk carrier.

2. Exchange the defective disk with a new one and assemble it in the disk carrier with the screws.

After that the SSD disk is replaced and the disk carrier with the new disk has to be reassembled in the system.

**Reassembling the System Disk**

After replacing the SSD disk, the disk carrier with the new disk has to be reassembled in the system.

Perform the following steps:

1. Slide the disk carrier back into its shaft at the disk array.

2. Push the disk carrier completely back into the shaft by applying pressure to the disk carrier directly (i.e. do not use the lever to push the carrier). Move it until you feel the resistance of the SSD disk interface inside the system and until the lever retracts by itself from the pushing.

> **NOTICE**
>
> **Using lever to push the carrier**
>
> When using the lever to push the carrier, it might be damaged.
>
> **It is important that you do not use the lever to insert the disk carrier. Apply an even pressure only to the carrier directly until the lever moves back by itself.**

3. Close the lever until it snaps back in place which as a result will slide the carrier completely back in.

> **i**  The disk carrier of the replaced disk should be level with the other.

4. Once the faceplate of the R&S system is back in place, the replacement of the SSD disk is finished.

| NOTICE | **Accesses to the Disk Array** |
|---|---|
| | During a rebuild, real-time processes may not be possible. It is recommended to restrict accesses to the SSD disk array until the rebuild is finished, as it takes several hours. |
| | **Rebuild time depends on the load of the system. It is recommended to avoid accesses or at least to restrict accesses to the disk array during this time, otherwise it may take considerably longer.** |

After several minutes the replaced SSD disk will be automatically recognized by the system. Then the rebuild of the data will be initiated on its own. When the system has finished the rebuild, the R&S system will be fully operational again.

## Replacing a Hard Disk of the Storage Array

As soon as the broken hard disk has been identified (see section "Identifying a Defective Disk" on page 50), it can be replaced easily.

| NOTICE | **Log Files** |
|---|---|
| | Before replacing a SSD disk you have to collect the log files of the RAID controller. If you know how to do this you may proceed on your own. If not, please contact the Rohde & Schwarz service department first. |

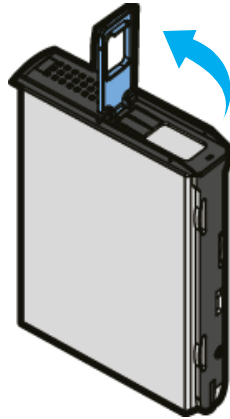**Removing the Hard Disk from the Array**

The hard disks are connected to the system with the help of disk carriers.

| i | For an overview of a disk carrier as well as further information about it see "Hard Disk Array" (page 20). |
|---|---|

Perform the following steps:

1. If appropriate, stop all accesses to the hard disk array of your system, for example, by exiting the software and severing the network connections.

2. Unlatch the disk carrier of the defective hard disk by pressing the opener of the disk carrier.



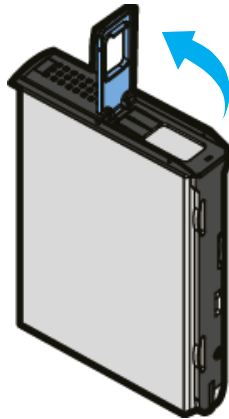3. Pull the disk carrier out of the system.

Now the hard is removed from the system and it has to be replaced in the next step.
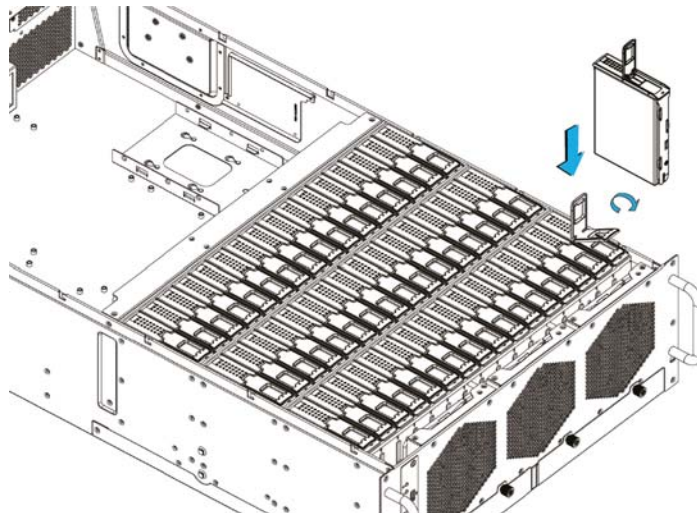
**Replacing the Hard Disk**

| | |
|---|---|
| **NOTICE** | **System Damage**<br><br>Significant environmental changes, for example, altitude, voltage, temperature, shock, vibration, etc., can damage a hard disk.<br><br>**Handle hard disks with great care.** |
| ℹ | It is best to use the same brand and type of hard disk again. Otherwise a loss of performance might occur. |

Perform the following steps:

1. Unlatch the disk carrier of the new hard disk by pulling up the opener of the disk carrier.



2. Carefully place the carrier from above and close the handle to mount the HDD.



| NOTICE | **System Damage** |
|---|---|
| | **Carefully place the hard disk carrier into place. Do not let it fall!** |

| i | The disk carrier of the replaced disk should be level with the others. |
|---|---|

**NOTICE**

**Accesses to the Disk Array**

During a rebuild, real-time processes may not be possible. It is recommended to restrict accesses to the hard disk array until the rebuild is finished, as it takes several hours.

**Rebuild time depends on the load of the system. It is recommended to avoid accesses or at least to restrict accesses to the disk array during this time, otherwise it may take considerably longer.**

When the system has finished the rebuild, the R&S system will be fully operational again.

# Controller Maintenance

During the service life of the R&S system you may have to exchange a RAID controller. It may be indicated, for example, if a disk set (RAID pack) cannot be accessed anymore. This section describes how to exchange a RAID controller.

| | |
|---|---|
| **NOTICE** | **Incorrect Maintenance** |
| | Incorrect exchange of the RAID controller can cause damages to the system. |
| | **Before exchanging a RAID controller contact the R&S service department.** |

| | |
|---|---|
| **⚠ DANGER** | **High Voltage** |
| | The system you are working on operates with voltages that can be hazardous to your health. |
| | **Never work on the system or access its interior with the power cable(s) being plugged in. Make sure the power supply is disconnected from the components you intend to work on.** |
| | **Maintenance inside the system should only be performed by personnel qualified for handling and testing electrical equipment.** |

| | |
|---|---|
| **NOTICE** | **Touching Hardware Components** |
| | Computer hardware contains components that are sensitive to electrostatic discharge. If you touch them without precautionary measures, they can be destroyed. |
| | **Use a wrist strap connected to ground when accessing electronic parts and take care of grounding the system. Avoid touching the internal components of the computer system.** |

Perform the following steps:

1. Identify the controller or disk set that causes the problem, for example, by consulting either the RAID software manager or the BIOS of the RAID (press [Ctrl + H on the SpycerBox Ultra TL] at the indicated moment during start-up of the system).

2. Open the casing of the system as described in "Opening the Casing" (page 33).

3. On the defective controller memorize the order of the cables that are connected to it. To make this easy the cables are numbered.

4. Disconnect the cables connected to the controller.

5. Remove the defective controller from the system and in its place install a new one.

| **NOTICE** | **Other Spare Parts** |
|---|---|
| | Others than the original manufacturer spare parts might damage your system. |
| | **Only use original manufacturer spare parts.** |

| **NOTICE** | **Wrong Controller Firmware** |
|---|---|
| | The wrong controller firmware might lead to incompatibilities and malfunctions of the system. |
| | **The new controller must have the same firmware installed as the other controllers.** |

6. Connect the cables to the controller again in the same manner as they were on the old controller.

7. Close the casing of the system.
   ▸ With the last step finished you have successfully replaced the defective RAID controller. Now, you have to integrate the new controller in the existing configuration.

**8.** Turn on the system.

▸ After the initial booting you will see an output that is similar to the following lines:

```
Following foreign Arrays are found:
<Array>
Press <Enter> to accept the current configuration
Press <Ctrl-A> to enter Adaptec RAID Configuration
Utility
Press <Ctrl-H> to Pause Configuration Messages
(Default i s not to accept if no valid key pressed
seconds)
```

**9.** Press [Enter] on the keyboard to accept the configuration detected by the system.

> Depending on the system you have purchased, you may see different lines on the screen and you may have to press e.g. **[F]** on the SpycerBox Ultra TL to accept the configuration.

> In some cases the boot device cannot be found after accepting a configuration. Then you have to specify the boot device in the BIOS of the RAID. To access the RAID BIOS press **[Ctrl + H]** at the indicated moment during the start-up of the system. The setting can be found after selecting the respective controller and switching to 'Virtual Drives'.
>
> If the newly installed RAID controller cannot be detected by the system or you see a system message indicating a degraded RAID array, please contact the R&S service department.

After this the newly installed RAID controller automatically initiates a verify of the connected disks which may take some time. When finished, the system will continue its booting procedure until the operating system is fully loaded. You may then continue your work with the system.

# Power Supply Maintenance

This section describes the maintenance of the power supply.

The following topics are covered:

- Power Supply  (page 61)
- Replacing a Power Supply Unit  (page 62)

## Power Supply

The redundant power supply provides the system with power. It is a reliable and enduring part of the system because it consists of several independent power supply units: Even if one fails the others will still offer enough power to keep the system working.

| | |
|---|---|
| **NOTICE** | **System Damage** |
| | The system can be operated with one power supply unit out of order. However, if another one fails, a continued operation of the system cannot be guaranteed. |
| | **Change a failed power supply unit immediately.** |

When a power supply unit failure occurs, you will be notified by a lit alarm LED and the sounding of an alarm buzzer of the system. The alarm can be switched mute with the mute button at the front of the system.

| | |
|---|---|
| **NOTICE** | **Alarm** |
| | An alarm can be caused by a number of reasons. Please refer to section "Troubleshooting" on page 72 first for further details about what to do in case of an alarm. |

Each power supply unit in the R&S system is hot-swappable, so you can safely replace it with the system running.

| | |
|---|---|
| **i** | For an overview of a power supply unit see section "Power Supply" on page 25. |

⚠ **CAUTION**    **Injury**

**Do not reach inside the system when removing a power supply unit or when the unit is out of the system.**

**NOTICE**    **System Damage**

Third-party spare parts might damage your system.

**Only use original manufacturer spare parts.**

## Replacing a Power Supply Unit

Perform the following steps:

1. Take a look at the power supply at the rear of the system and examine the LEDs of the units. The LED of the malfunctioning power supply unit should be either extinguished or lit in red.

2. Next unplug the power cord from this power supply unit.

3. Unscrew the security screw of the power supply.



handle    LED    latch    power cable socket
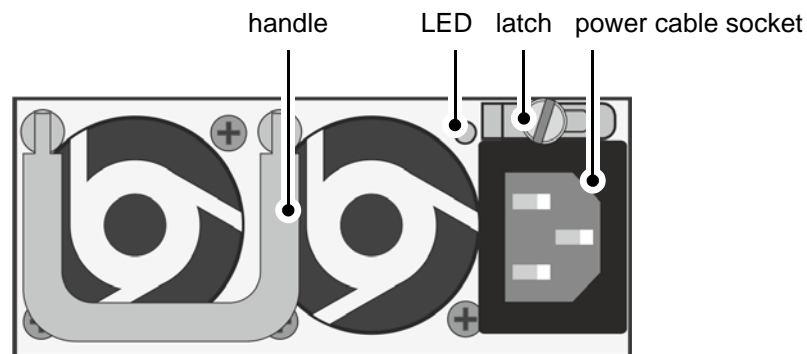
4. Take the handle of the respective unit and press the unit's latch to the left to unlock it.

5. Then pull the unit at its handle out of the power supply.

6. Change the power supply unit against a new and operable one.

7. Slide the new unit into the power supply until it clicks into place.

When completely inserted please observe that the latch is truly in place and locking the unit.

8. Tighten the security screw of the latch again.

9. Connect the power source (power cord) to the newly installed power supply unit.

10. Check the LED indicating the status of the power supply unit: If it is lit up in green, the unit is working properly.

The power supply unit has been replaced successfully.

# Backup or Recovery of the System Disk

The R&S system provides internally a USB flash drive that can be used to restore the operating system on the system disk back to its manufacturing state. Once selected as a boot device, it will launch a Live Linux which in turn will restore the system disk.

## Creating a Backup Image of the System Disk

| NOTICE | **Total Loss of Data** |
|---|---|
| | Selecting the wrong device can lead to a total loss of data. |
| | **Do not execute any commands if you are not sure about the correct source and target device.** |

Perform the following steps:

1. If appropriate, disconnect all Fibre Channel cables and all externally connected storage devices from the system.

2. Turn on or restart the R&S system and at the indicated moment during start-up press **[F11]** on your keyboard to enter the boot menu.

3. Once the boot menu is displayed on the screen, select the internally installed USB flash drive as the boot device and then press **[Enter]** on your keyboard.
   ‣ The system will now boot from the internal USB and you will see a window on the screen where you can select the R&S Rescue environment for loading.

> To complete the loading of the R&S Rescue environment some user entries are required. For this follow the instructions given on the screen.
>
> The loading of the environment and the process itself will both try to initialize hardware that may not be present on your system. Any error messages displayed during loading/initialization, e.g. **Failed or Warning,** can be disregarded. The backup/recovery process should work nonetheless.

**4.** Select DVS Rescue and press **[Enter]** on your keyboard.

> ▸ Once the loading has finished, you will see the DVS Rescue script with its options on the screen. Your display should look similar to the following:

```
--- DVS Rescue ---

1 - Backup on internal USB device
2 - Restore from internal USB device
3 - Reboot the system
4 - Poweroff the system

0 - Exit

Enter selection:
```

**5.** To make a backup image of your system disk and save it to the internal USB, press [1] and then **[Enter]** on your keyboard.

> ▸ A list of possible target devices will be detailed on the screen. The system disk normally is the 'ATA' disk with, for example, **sda**, **sdb** or **sdc** as its device name.

> ℹ️ Ex factory the R&S system will be delivered with **sdc** as the default system disk. If other configurations have been made later or on customer request, this may be different.

> **NOTICE** | **Data Loss**
>
> Selecting the wrong source device may lead to an unwanted configuration and malfunctions when the system is operating.
>
> **Continue with the following steps only when you are able to identify the correct source device.**

**6.** Enter the name of the system disk: Type in e.g. **sda** (or in other cases **sdb**, **sdc**, etc.) and press **[Enter]** on your keyboard.

> ▸ The system will now ask you to enter the image name for your backup image to be saved. By entering the name of an already existing backup image you can overwrite it.

7.  Type in the name of the image you want to save to the USB and press **[Enter]** on your keyboard.
    ‣ The system will ask you to confirm your selection and whether you want to continue:

8.  To start the backup process type in  **y** for 'yes' and press **[Enter]** on your keyboard.
    ‣ The program will now start the backup process. Its progress will be indicated on the screen.

> To abort the process at this point enter **n** for 'no' and press **[Enter]** on your keyboard. You will be redirected to the DVS Rescue script.
>
> After starting the process a termination is no longer possible.

> The backup process may take some time.
>
> If during the process the screen turns black, press **[Space]** to get it back again.

When the system has finished the backup process, you will be notified. Then after pressing **[Enter]** on your keyboard, you will be redirected to the DVS Rescue script once more where you can choose, for example, 'reboot' or 'poweroff' to restart or turn off the system.

## Restoring the System Disk

> **NOTICE**
>
> **Total Loss of Data**
>
> Selecting the wrong device can lead to a total loss of data.
>
> **Do not execute any commands if you are not sure about the correct source and target device.**

Perform the following steps:

1. If appropriate, disconnect all Fibre Channel cables and all externally connected storage devices from the system.

2. Turn on or restart the R&S system and at the indicated moment during start-up press **[F11]** on your keyboard to enter the boot menu.

3. Once the boot menu is displayed on the screen, select the internally installed USB flash drive as the boot device and then press **[Enter]** on your keyboard.
   ‣ The system will now boot from the internal USB and you will see a window on the screen where you can select the R&S Rescue environment for loading.

> To complete the loading of the R&S Rescue environment some user entries are required. For this follow the instructions given on the screen.
>
> The loading of the environment and the process itself will both try to initialize hardware that may not be present on your system. Any error messages displayed during loading/initialization, e.g. **Failed or Warning,** can be disregarded. The backup/recovery process should work nonetheless.

4. Select Rescue and press **[Enter]** on your keyboard.
   ‣ Once the loading has finished, you will see the R&S Rescue script with its options on the screen. Your display should look similar to the following:

```
--- DVS Rescue ---

1 - Backup on internal USB device
2 - Restore from internal USB device
3 - Reboot the system
4 - Poweroff the system

0 - Exit

Enter selection:
```

**5.** To restore your system disk from the internal USB, press [2] and then **[Enter]** on your keyboard.

‣ A list of possible target devices will be detailed on the screen. The system disk normally is the 'ATA' disk with, for example, **sda**, **sdb** or **sdc** as its device name.

> ℹ️ Ex factory the R&S system will be delivered with **sdc** as the default system disk. If other configurations have been made later or on customer request, this may be different.

> **NOTICE** **Data Loss**
>
> A recovery will overwrite all your data.
>
> **Continue with the following steps only when you are able to identify the correct target device.**

**6.** Enter the name of the system disk: Type in e.g. **sda** (or in other cases **sdb**, **sdc**, etc.) and press **[Enter]** on your keyboard.

‣ Another list will be displayed on the screen detailing the possible source images. If there is only the R&S recovery image on the USB flash drive, this one will be listed. If there are several images, all will be displayed.

**7.** Type in the name of the image you want to save to the USB and press **[Enter]** on your keyboard.

‣ The system will ask you to confirm your selection and whether you want to continue:

**8.** To start the recovery process type in **y** for 'yes' and press **[Enter]** on your keyboard.

‣ The program will now start the recovery process. Its progress will be indicated on the screen.

> ℹ️ To abort the process at this point enter **n** for 'no' and press **[Enter]** on your keyboard. You will be redirected to the Rescue script.
>
> After starting the process a termination is no longer possible.

The backup process may take some time.

If during the process the screen turns black, press **[Space]** to get it back again.

When the system has finished the recovery process, you will be notified. Then after pressing **[Enter]** on your keyboard, you will be redirected to the Rescue script once more where you can choose, for example, 'reboot' or 'poweroff' to restart or turn off the system. The next time the R&S system is started, it will load the restored operating system.

# Appendix

This chapter gives some hints how to resolve irregularities during operation. Also, technical data and general information about the R&S system are provided.

This chapter is divided into the following sections:

- Troubleshooting  (page 72)
- Technical Data  (page 76)
- Packing Instructions  (page 78)

# Troubleshooting

The table below lists some errors that may occur during the operation of the R&S system and details how to resolve them. If you experience trouble that cannot be resolved with the solutions described here or in chapter "Maintenance" (page 47), please contact your local vendor or R&S directly.

| Error | Cause | Solution |
|---|---|---|
| Accesses to the main storage are slow | The data storage is too full. | It is recommended to use only 85 to 90% of the overall disk capacity. If the storage is too full, delete some of your data. |
| | One or more hard disks of the hard disk array are worn. | Try to identify the worn disk and replace it as described in section "Disk Maintenance" on page 48. |
| | Configurations of the system or its network ports have been altered. | Contact your local system and network administrator and try to reconfigure the network connections of the system. If this is not successful contact the R&S service department. |
| | A RAID controller is defective. | If you can rule out the above mentioned causes, a RAID controller may be defective. Before attempting to exchange a RAID controller (see section "Controller Maintenance" on page 58) contact the R&S service department. |

| Error | Cause | Solution |
|---|---|---|
| The system does not boot. Error message: "No operating system found" OR The system cannot find the device to boot from. OR The system boots from an external device. | An external bootable storage device is connected to the system. | Shut down the system as described, disconnect the external bootable storage device and put the system back into operation. If the system still does not boot correctly, change the boot order in the BIOS setting or contact the R&S service department. |
|  | The boot order in the BIOS settings is wrong. | Correct the boot order in the BIOS setting or contact the R&S service department. |
|  | The system disk(s) is/are broken. | Try to identify the worn disk and replace it as described in "Disk Maintenance" (page 48). |
| An alarm is sounded and the alarm LED is lit. The alarm can be switched mute with the mute button. | One of the power supply units has been disconnected from power during operation. | Check the LEDs of the power supply units. If one is extinguished, this unit may be disconnected from power. Examine the power cord of the unit. See to it that it is in good technical order, correctly plugged in at both ends and that the mains current is operating properly. |
|  | One of the power supply units has failed. | Check the LEDs of the power supply units. If one is extinguished and you can rule out the above mentioned cause, a power supply unit has failed. Replace the broken unit as described in section "Power Supply Maintenance" on page 61. |

| Error | Cause | Solution |
|-------|-------|----------|
|  | A fan has failed. | If in doubt, whether a fan is defective, please contact R&S support. |
|  | The system is overheated. | If you can rule out the above mentioned causes, the alarm must be due to overheating. See to it that the ambient temperature at the front of the system does not exceed the operating temperature specified in section "Technical Data". If the temperature is within the range, check the ventilation holes of the system and free them from all obstructions (e.g. dust). In case the problem persists, contact the R&S service department. |

| Error | Cause | Solution |
|-------|-------|----------|
| An alarm is sounded and the alarm LED is off. The alarm cannot be switched mute with the mute button. *OR* At start-up the system is not able to initialize a disk set. | A disk or a disk carrier got loose/jammed (e.g. after transport) or is not mounted correctly. | Shut down the system. Then perform the following: Pull all disk carriers partially out of the chassis and afterwards install them again. See to it that they are pulled out and reassembled correctly as described in section "Replacing a System Disk" on page 51. After that start the system again. |
| | A hard disk of the hard disk array is defective. | Replace the defective disk as explained in section "Replacing a Hard Disk of the Storage Array" on page 54. |
| | A RAID controller is defective. | If you can rule out the above mentioned causes, a RAID controller may be defective. Before attempting to exchange a RAID controller (see section "Controller Maintenance" on page 58) contact the R&S service department. |

# Technical Data

This section provides technical data of SpycerBox Ultra TL.

The following topics are covered:

- ■ General Technical Data  (page 76)
- ■ Dimensions  (page 77)

## General Technical Data

**Technical data**

| | |
|---|---|
| **Chassis weight** | Approx. 36.7 kg |
| **Chassis weight with drives** | Approx. 67.9 kg |
| **Environment (also during transport)** | No exposure to heat<br>No exposure to strong electric or magnetic fields<br>No vibrations/shocks allowed |
| **Operating temperature** | Maximum:10 - 30 °C (50 - 86 °F)<br>Optimum:15 - 25 °C (59 - 77 °F) |
| **Storage temperature** | 0 - 50 °C (32 - 122 °F) |
| **Humidity** | 10% to 80% RH @ 30°C, non-condensing |
| **Non-operating humidity** | Up to 85% RH @ 30°C, non-condensing |
| **Air** | Dust-free |
| **Power consumption** | 1184 W max. input power<br>911.4 W typ. input power<br>641 W idle power |
| **Input power requirements** | 100 - 240 V @ 47 - 63 Hz |

## Dimensions

The following figure shows the dimensions of the system. The drawing already includes some space for connectors and plugs that can protrude from the rear ('plug safety' (l minus j), usually plus 150 mm). However, this amount of space depends on the type of connectors used.
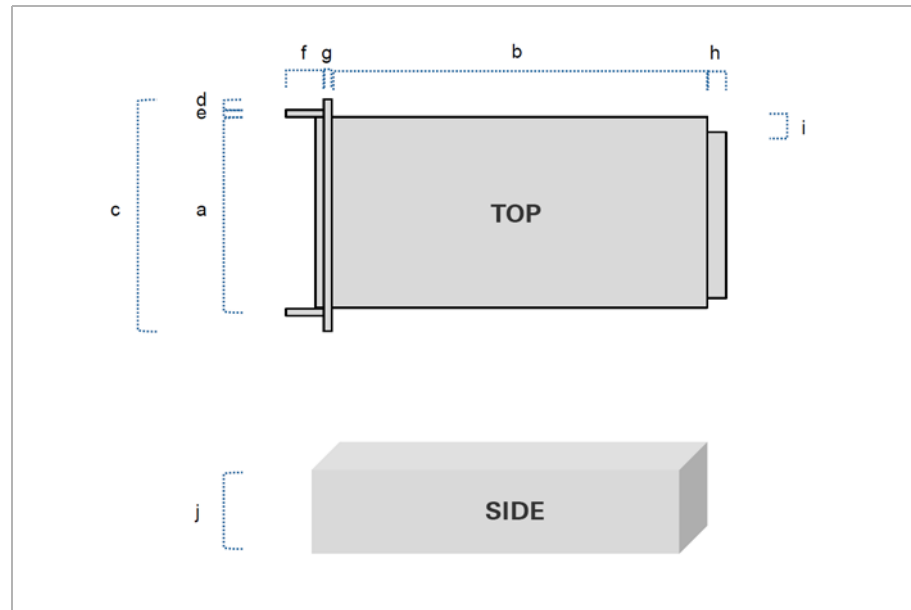


Dimensions of the system

| a | 438 mm | f | 44 mm |
|---|--------|---|-------|
| b | 795 mm | g | 2 mm |
| c | 480 mm | h | 12 mm |
| d | 11 mm | i | 5 mm |
| e | 10 mm | j | 176 mm |

# Packing Instructions

The following describes the best way to pack the system.

## Safety

| NOTICE | **Transportation Damage** |
|---|---|
| | If you do not have the original packing anymore, use a similar structured packing for transportation. R&S cannot be held liable for transportation damages. |
| | **Keep the original packing and use it in case of transportation. Otherwise the warranty will be void.**<br>**In any other case, if you do not have the original packing anymore, use a similar structured packing for transportation. R&S cannot be held liable for damages due to transportation.** |

| | Fragile. Avoid shocks or vibrations. For longer distances use a lifting device. |
|---|---|
| | Keep dry. |

## Packing the System

Perform the following steps:

1. Wrap the video system in foil.
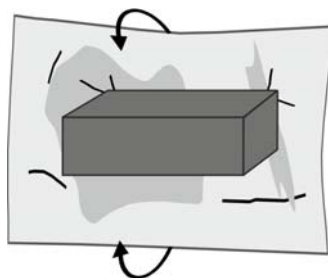
2. Pack the system in the box and place it on the pallet.
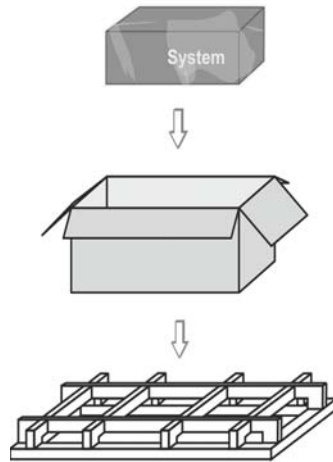


3. Pack the accessories in a box.
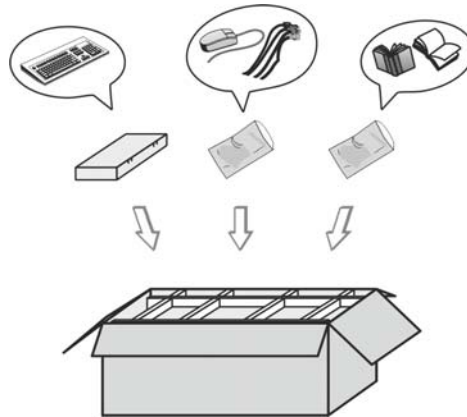
**4.** Place the hard disks of the left ant right disk sets in the original tablets provided. Pack the tablets in the appropriated boxes.
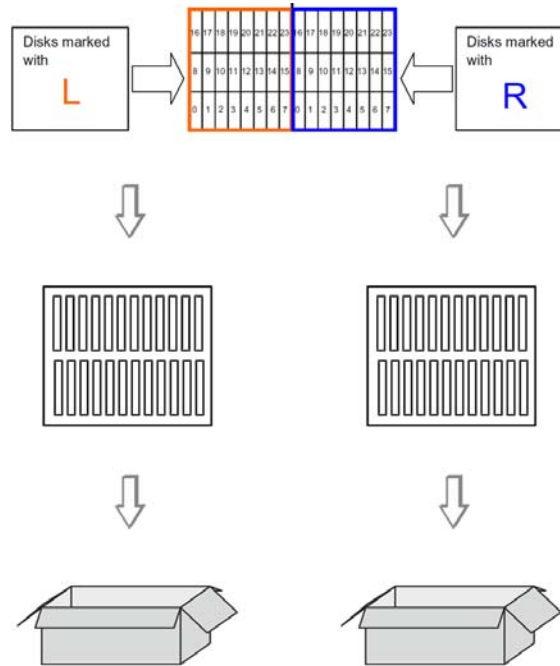


**5.** Place all the boxes on the pallet as shown.
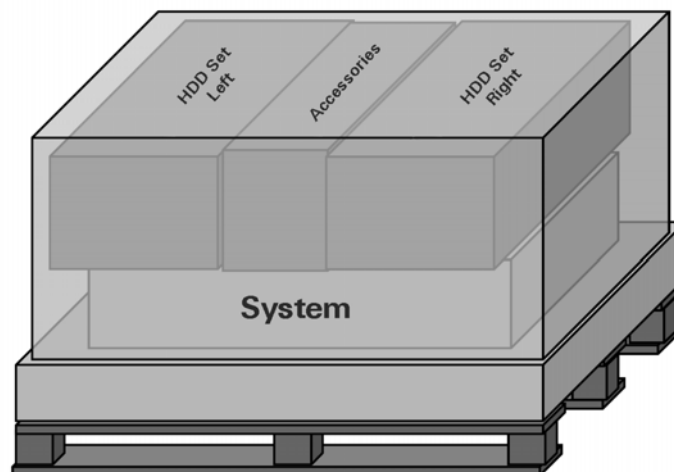


The system has been packed.

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