R&S®Tx9
Transmitter System
Operating Manual

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For information only!
This manual, dated April 25, 2014 reflects the technical status as of that date. There may have been technical changes since that time.

Broadcasting

Operating Manual

ROHDE&SCHWARZ

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Mühldorfstr. 15, 81671 München, Germany
Phone: +49 89 41 29 - 0
Fax: +49 89 41 29 12 164
E-mail: info@rohde-schwarz.com
Internet: www.rohde-schwarz.com
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North America

Phone 1-888-TEST-RSA (1-888-837-8772)
customer.support@rsa.rohde-schwarz.com

Latin America

Phone +1-410-910-7988
customersupport.la@rohde-schwarz.com

Asia/Pacific

Phone +65 65 13 04 88
customersupport.asia@rohde-schwarz.com

China

Phone +86-800-810-8228 /
+86-400-650-5896
customersupport.china@rohde-schwarz.com

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1 Information about this Manual

This manual is part of the documentation for the R&S THU9 transmitter family from Rohde & Schwarz. The individual manuals for the transmitter family have a modular structure and complement each other.

Structure

The system manual, which is the central and overarching part of the overall documentation, describes all the steps involved in installing a transmitter.

Operation of the transmitter system after installation and the steps required to put the system into operation are described in the operating manual.

The service manual describes all maintenance, troubleshooting and service tasks that customers can carry out themselves. At certain points in the transmitter manual, the reader is referred to the appropriate operating manual or service manual.

Contents

The manuals for the transmitter family describe all activities required for installation, startup, operation, maintenance, troubleshooting and servicing of the transmitter and its component parts. The appendix contains the interface descriptions and the technical documentation.

Safety

All skilled personnel working with a transmitter or its components have a duty to read the associated manuals and to follow the safety measures described in the section "Safety" and given at appropriate points in the manual. It must be ensured that the transmitter and the individual components of the transmitter are used only for their intended use. All activities connected with the transmitter or individual transmitter components must be carried out by skilled personnel. If activities require additional skills and qualifications, this is indicated at the appropriate points in the manual.

Symbols and notation

The "warning triangle" symbol refers the reader to potential hazards. The degree of danger is indicated by different signal words next to the warning symbol.

Instructions are given in numbered steps. All other formatting options are intended to improve clarity and are self-explanatory.

3 Introduction to Operation

The R&S TDU900 is a display unit with a touchscreen function and a graphical user interface for configuring Tx9 transmitter systems.

3.1 Operation via R&S TDU900

3.1.1 Opening Display

When in the idle state, the display is inside the R&S TDU900 operating unit.

1. Unlock the display by pressing firmly on the trapezoidal area.
2. The display slowly slides forward out of the instrument.
3. Tilt the display until you have reached the most ergonomically comfortable angle for operation.

3.1.2 Closing Display

1. Tilt the display to a horizontal position until you feel the display engage.
2. Push the display all the way into the R&S TDU900 housing until the display engages in the transport lock.
3. The display illumination automatically switches off in this state.

   Tip: Close the operating unit during long periods of inactivity to prolong the service life of the backlighting.

3.1.3 Using Touchscreen Function

The display has a touchscreen function for operating all of the transmitter functions.

Using sharp-edged objects can damage or destroy the surface. Therefore only use your finger to operate the touchscreen.

1. A light touch on a button is enough to trigger a user action.
2. A button lights up orange for as long as your finger remains there. The action is not carried out until you remove your finger from the button.

Tip: To cancel an inadvertently selected action, slide your finger to the side away from the button highlighted orange and then lift your finger off the touchscreen.

3.2 Operation via Browser

The graphical user interface (GUI) of the Tx9 transmitter series has been implemented in JAVA to ensure optimum user experience. Java technology provides maximum compatibility between different versions of operating systems and browsers.

Supported operating systems

- Windows XP, Windows Vista (32 bit version)
- Windows 7 (32 bit and 64 bit version)
- Windows 8 (32 bit and 64 bit version)

Supported browsers

- Google Chrome
- Mozilla Firefox
- Internet Explorer 7
- Internet Explorer 8
- Internet Explorer 9 (32 bit version)
- Internet Explorer 10 (32 bit and 64 bit desktop version)

Supported JAVA virtual machines

- Oracle (previously: Sun) JRE 7 in 32 bit version

Troubleshooting

You can ensure trouble-free operation of the GUI in a browser by installing the browser and the Java VM with their default settings on a computer configured with its factory settings.

The following solutions are available if the computer settings differ from the standard installation and there are problems:

- The 64 bit version of Internet Explorer 9 is not supported
  - The 32 bit version, which is also installed, must be used
  - Use another browser, such as Google Chrome or Mozilla Firefox.
- Internet Explorer 10 is to be used on a 64 bit operating system (Windows 7/8): "Enhanced Protection Mode" must be disabled in the browser under "Tools > Options > Advanced" (this is the default setting).
- Windows 8 Modern UI (previously: Metro) does not support Java.
  - Start the desktop version of Internet Explorer 10 from the desktop.
  - Start Google Chrome or Firefox from a link in Modern UI.
- The error message "Application blocked by security settings" appears on the login page.

Set the security level to "High" in the Java Control Panel and restart the browser.

- Only a 64 bit Java runtime environment (JRE) is installed.
  Remove the 64 bit JRE and install the 32 bit version.
- A 64 bit JRE is installed and required by another application (unlikely)
  Install a 32 bit JRE to run in parallel with the 64 bit version.

You can determine the Java version (32 or 64 bit) as follows:

- Open an input prompt window (Start > Run > Open, insert "cmd" and press <OK>)
- Enter: java -d32 -version
- The version number is shown if a 32 bit JRE is installed, otherwise an error message appears.

Java security

In order to ensure the optimum protection against malicious software (malware), the user interface for the Tx9 transmitter series has been implemented in Java. Java technology eliminates the need to run potentially unsafe ActiveX or Flash plug-ins in your browser. Java offers numerous security functions:

- Java security settings
  The security level in the Java Control Panel should be set to "High". A corresponding security warning appears then appears when opening a website with Java contents; you have to acknowledge this message. This prevents Java programs from untrusted websites from being started unintentionally.
- Detecting a secure browser
  The Java version installed on the computer should be displayed at the bottom left corner of the login page only after the security notice for running Java code has been confirmed. If the Java version is displayed without confirming the security notice, then you are using an unsecured browser or an outdated version of Java on your computer.
- Detecting the right web server
  The security notice for running the Java code shows the IP address of the transmitter that loaded the Java code to the browser.

Transmitters in the Tx9 series are protected against malware by various security measures. Nevertheless, it is important to follow this general information on security to protect other computers in the same network against malware:

- Always keep your browser updated to the latest version!
- Always update your Java runtime environment to the most recent version immediately after starting your browser.
- Avoid using unsecured browsers, such as MS Internet Explorer 7.
- Always use a firewall to display Internet pages from servers outside your LAN.
- The transmitter should be accessible within its protected intranet at all times. If this is not technically feasible, take additional measures to secure communications between the transmitter and browser (e.g. via a VPN).

3.2.1 Connection Setup and Login

1. Create a physical network connection to the transmitter. The following options are available:
   a) Remote access via WAN (Wide Area Network)
   b) Local access directly to a transmitter using a LAN cable
2. Start the browser and enter the following information in the address bar:
   a) IP address of the transmitter

   The website for operating the transmitter is called (login page).
3. Enter your user name and password.

   Note: The following login information is preconfigured at the factory
   - User name: Query
     Password: 1234
   - User name: Operation
     Password: 1234
   - User name: Maintenance
     Password: 1234
   - User name: Configuration
     Password: 1234

   Change the user names and passwords after logging in for the first time chapter 3.3.7.2, "Managing Users", on page 32.

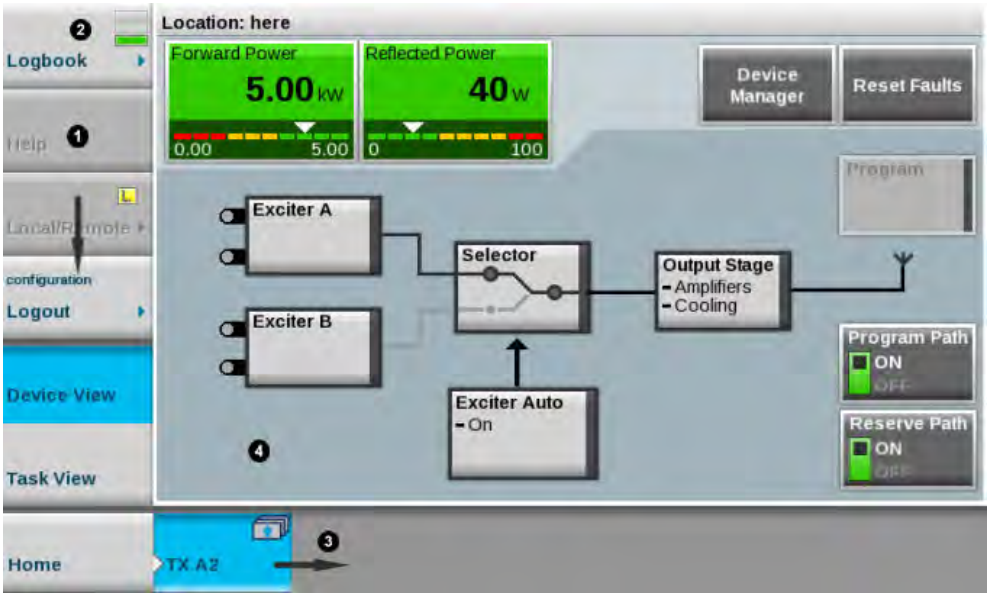
   After successfully logging in, the actual user interface is displayed.

3.3 Structure of User Interface

3.3.1 Elements of User Interface

The user interface is composed of the following elements:

- Menu bar:
  The menu bar provides access to the most important functions.
- System status:
  This display provides a constantly visible, general overview of the entire system status.
- Path bar:
  The path bar shows the current position within the menu structure and provides the ability to quickly return to higher menu levels.
- Working area:
  The various tasks and configuration steps are carried out in the working area.



1 = Menu bar
2 = System status
3 = Path bar
4 = Working area

3.3.2 Views

The user interface provides two different views of the transmitter system:

- Device View
- Task View

Device View

In this view, all of the transmitter's functions are structured in the form of block diagrams. All parameters relevant to operation are accessible.

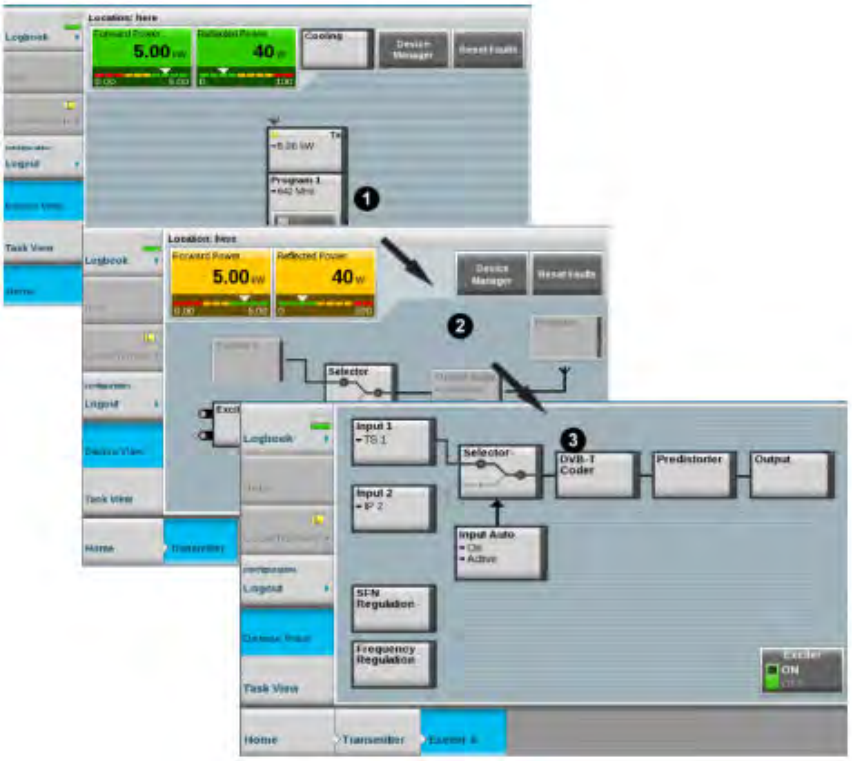


Fig. 3-1: Hierarchical structure of a transmitter system

1 = View at transmitter system level
2 = View at single transmitter level
3 = View at exciter level

Task View

This view combines certain, frequently recurring tasks. A task includes exactly those cross-instrument parameters which are required for working on this task. All of the parameters relevant to startup and maintenance are accessible.

Certain parameters are only accessible in the Task View.

3.3.3 Basic Functions on Menu Bar

All of the functions of a R&S TDU900 required for basic operation of a transmitter are combined on the menu bar.

The following functions are available:

- Logbook
- Help
- Local/Remote
- Login/Logout

- Device View
- Task View.

3.3.3.1 Logbook

The logbook is used for logging all system events and for troubleshooting and error analysis.

3.3.3.2 Help

This button is used to activate the help function. The following steps must be performed:

1. Press the Help button.

   All of the elements for which help information is available are identified by a blue frame.

2. Select the desired element.

   The corresponding help information is shown in a separate window.

3.3.3.3 Local/Remote

The transmitter can be operated via both local access and via remote access.

The Local/Remote button allows you to toggle between the two types of access.

The transmitter can be switched from remote operation to local operation from at any time.

For safety reasons, remote operation is not possible if the system is currently being operated locally.

The current status (L = Local, R = Remote) is shown directly on the Local/Remote button. The corresponding status of each transmitter is shown individually for multi-transmitter systems.

3.3.3.4 Login/Logout

The login dialog allows a user to log in or log out of the system.

3.3.3.5 Device View

This button is used to switch to the Device View.

3.3.3.6 Task View

This button is used to switch to the Task View.

3.3.4 Navigation

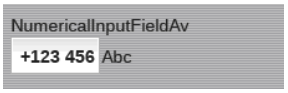
The Device View is used to navigate through the transmitter menus. Pressing one of the visibly raised block diagram elements allows you to navigate further into the transmitter structure. Parameters that may be spread out over multiple tabs are located on the lowest menu level. A path bar is shown at the bottom of the screen. :

This has two functions:

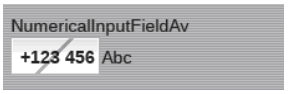
- Displaying the current menu level
- Returning to higher menu levels

3.3.5 Input Fields

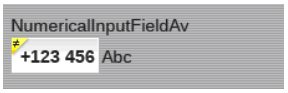
Additional information regarding the editability of respective parameters is visualized using icons on the display and input fields. The various display forms have the following meaning:

- 

  This value can be edited without restriction.

- 

  This value can be edited, but has no effect in the current configuration.

- 

  This value has been changed and has not yet been stored in a preset.

-

  This value cannot be edited with the user rights currently in effect.

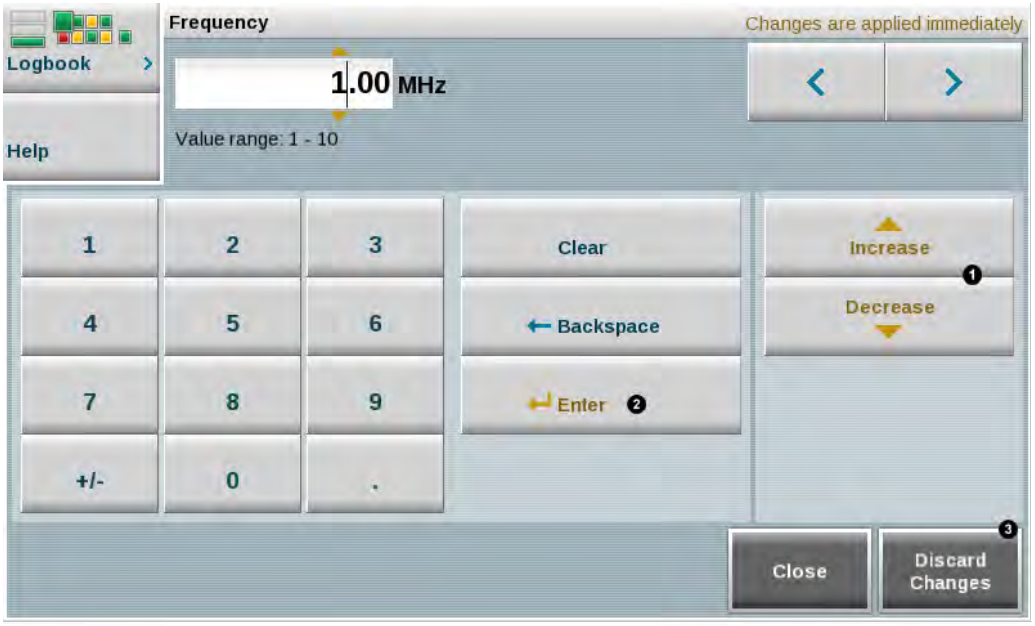
3.3.6 Editors

All of the functions of a R&S TDU900 required for basic operation of a transmitter are combined on the menu bar.

The following functions are available:

3.3.6.1 Numeric Editor

The numeric editor features the following functions.



1 = By pressing one of these buttons, the value is changed directly in the display without the use of the enter button.
2 = The value entered using the numeric keypad is accepted by the system by pressing this button.
3 = Pressing this button discards all of the changes made in this window and restores the original value.

Violating the allowed value ranges causes an error message to appear and disables the input elements (Increase/Decrease/Enter).

3.3.6.2 Text Editor

The text editor allows letters, digits and special characters to be entered.

3.3.7 Special Tasks

3.3.7.1 Finding an Error

There are two ways of locating an error:

- Block diagrams
  You can use the traffic light signaling of the elements in the block diagrams to find the cause of an error in just a few steps, as long as the error is currently active.

Valuable information about an error's cause and tips for correcting the error can be retrieved using the help function of the respective error message.

- Logbook
  Complex error situations including behavior over time can be analyzed using the logbook. The help function again provides a multitude of valuable information.

3.3.7.2 Managing Users

User management is only available if the R&S TDU900 is operated using a browser. The following login must be selected for this purpose:

User name: Superuser

Password: 1234

For more details, see chapter 7, "User Administration", on page 257.

3.3.8 Logbook

All system events are recorded in the logbook. The following functions are available for simplifying troubleshooting and error analysis:

- Intelligent filtering
  Events are intelligently prefiltered based on the context of the menu currently open.
- Chronological view
  Events are shown in their chronological order. Associated events are marked accordingly.
- Manual filter (Filter and Options)
  Events or event groups can be chosen selectively with the help of specific criteria.
- Scroll function
  Enables fast navigation in long event lists

3.3.8.1 Intelligent Filtering

Depending on which menu is used to open the logbook, only events relevant in the context of the respective menu are displayed. These filters significantly increase clarity in the logbook.

- System overview
  Opening in the system overview: With MultiTX and N+1 systems, shows all of the events affecting the core components (e.g. cooling, N+1 automatic switchover) as well as the most important messages from individual transmitters within the system. With SingleTX systems, all of the detailed messages from the transmitter are also shown.
- Transmitter level:
  Opening in a transmitter-specific menu: Shows in detail all of the events that affect the respective transmitter (incl. exciters).

Depending on which menu is used to open the logbook, only events relevant in the context of the respective menu are displayed. These filters significantly increase clarity in the logbook.

- Exciter level
  Shows in detail all of the events that affect the respective exciter.

A total of up to 500 events is logged in the logbook.

3.3.8.2 Chronological View

All of the event messages are listed here in strictly chronological order. The most recent messages are always shown at the top of the list.

Fig. 3-2: Logbook – chronological view

A thread consists of a group of messages that refer to the same event. The color of the thread is determined by the most critical message within the thread. Clicking a thread marker opens a window containing the associated messages.

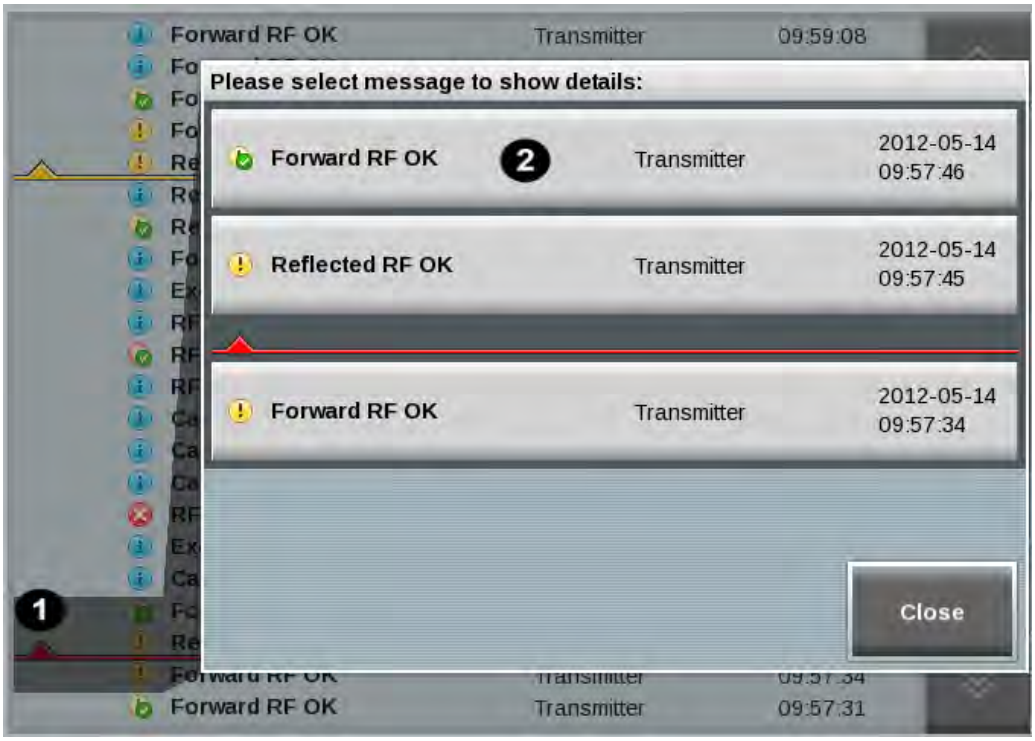


Fig. 3-3: Logbook – thread

1 = Thread marker
2 = Click to open detail view

For most messages there is an entry indicating when the message occurred and when it disappeared.

Each entry consists of the following information:

- Alarm level
  - Error
  - Error no longer present/remedied
  - Warning
  - Warning no longer present
  - Info
- Error message text
- System component (control, amplifier, exciter, etc.)
- Time

Clicking an entry within the thread view displays a detailed description with the following contents.

- From: / To:
  Displays the time when an event starts or ends.
- State:
  Indicates whether an event is still active or already remedied.
- Duration:
  Indicates how long an event was active.
- Component:
  Indicates the system components affected by an event.
- Description:
  Displays a detailed description of an event.

3.3.8.3 Manual Filter (Filter/Options)

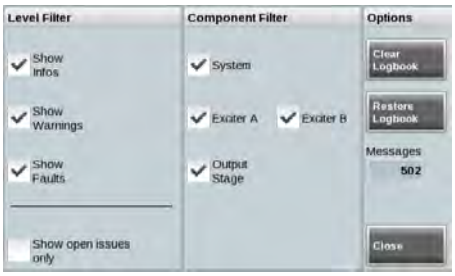


Fig. 3-4: Logbook – filter/options

The filter function allows filtering of the messages according to the following criteria:

- Level filter:

The messages can be filtered selectively according to individual or multiple levels (Info | Warning | Fault) at the same time by selecting/deselecting the checkboxes "Show Infos", "Show Warnings" and "Show Faults".
Selecting the "Show open issues only" checkbox will cause only messages that are still active to be displayed, in other words, messages that still have not been remedied,

- Component filter:
  The messages can be filtered selectively according to individual or multiple system components (System | Exciter A/B | Output Stage) at the same time by selecting/deselecting the checkboxes.
- Options:
  The following options are available:
  – Clear logbook
    "Clear Logbook" is used to completely delete the contents of the logbook.
  – Restore logbook
    "Restore Logbook" is used to restore the logbook after it has been inadvertently deleted.
  – Messages
    The "Messages" display shows the number of entries in the logbook.
  – Close
    "Close" is used to close the entire filter function.

3.3.8.4 Scroll Function

The scroll function enables navigation within a long event list and the selection and detailed view of specific events.

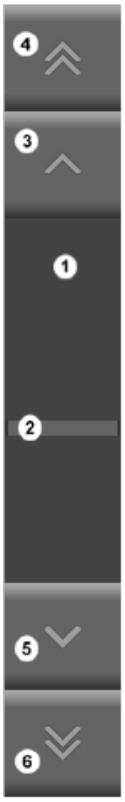


Fig. 3-5: Scroll functions

1 = Scroll box
2 = Scroll thumb
3 = Entry up
4 = Page up
5 = Entry down
6 = Page down

Clicking inside the scroll box moves the "scroll thumb" directly to the corresponding position.

Entry down: This button is used to scroll down by one entry in the direction of the oldest date.

Entry up: This button is used to scroll up by one entry in the direction of the most recent date.

Page down: This button is used to scroll by one page at a time in the direction of the oldest date.

Page up: This button is used to scroll by one page at a time in the direction of the most recent date.

4 Device View Description

4.1 System Overview

The screenshot below shows the Device View Home menu view. It represents the transmitter system level. The function of the individual buttons and the meaning of specific parameters are explained in the following chapters.

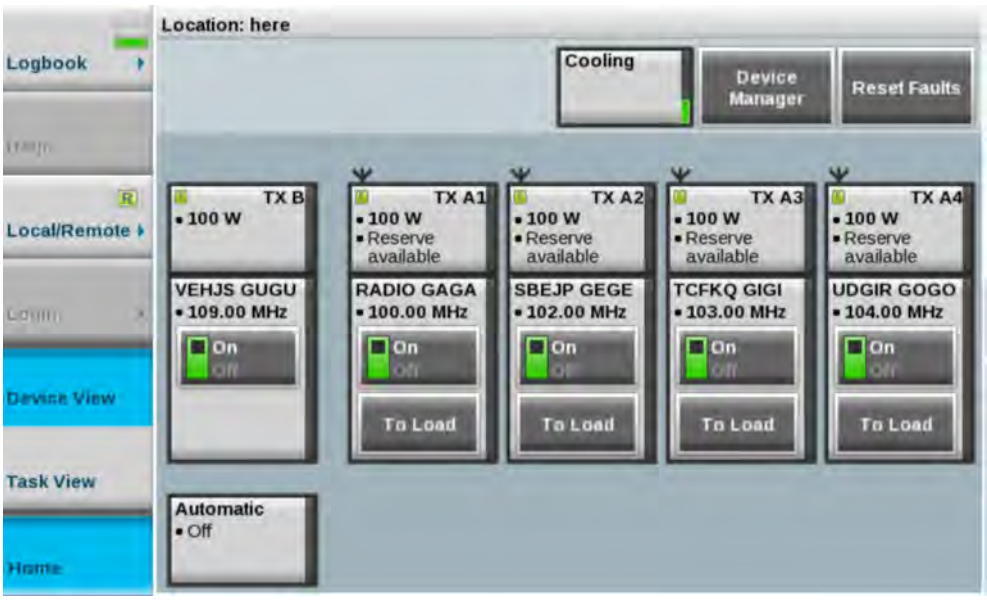


Fig. 4-1: Device View Home menu view

4.1.1 Forward Power

- **Path:***Device View Home > TX An*

The "Forward Power" field shows the forward power of the transmitter system in kW. This field lights up green provided that the forward power is above the user-selectable warning threshold. If the forward power drops to the warning level, the field lights up yellow. If the forward power drops below the user-selectable fault threshold, the field lights up red.

Pressing the green area opens the "Power and Limits" view. The following user-selectable values are displayed in the Forward Power field:

- Power (in percent)
  Forward power: can be set between 0 % and 130 %. The nominal transmitter power corresponds to 100 %.
- Warning Limit (in dB)
  Warning threshold: can be set between 0 dB and −20 dB.

- Fault Limit (in dB)
  Fault threshold: can be set between 0 dB and −20 dB.
- RF Fail Timeout (in s).
  Delay time: can be set between 0 s and 10 s. This is the time between undershooting of the "Fail Limit" fault threshold and indication of the fault in the transmitter status display.

4.1.2 Reflected Power

- **Path:***Device View Home > TX An*

The "Reflected Power" field indicates the reflected power of the transmitter system in W. This field lights up green provided that the reflected power is below the user-selectable warning threshold. If the reflected power exceeds this threshold, the field lights up yellow. If the reflected power exceeds the user-selectable fault threshold, the field lights up red.

Pressing the green area opens the "Power and Limits" view. The following user-selectable values are displayed in the Forward Power field:

- Warning Limit (in dB)
  Warning threshold: can be set between −28 dB and −17 dB.
- Fault Limit (in dB)
  Fault threshold: can be set between −17 dB and −14 dB.

4.1.3 Transmitter

The icons and buttons for the TX A1 to TX An and TX B transmitters (depending on the system configuration) are shown in the *"Device View Home"* menu overview.

The function of the buttons is explained in the next chapter, see chapter 4.2, "Transmitter", on page 43.

Name	Description	Value range	Access right
Program On	Switch used to switch the components in the program path of the transmitter on and off.	Off; On	Operation
Reserve On	Switch used to switch all components in the standby path of the transmitter on and off (standby exciter with "dual drive" redundancy concept and standby output stage with "active PA Reserve" redundancy concept).	Off; On	Operation
Reset Faults	Switch used to reset all faults stored in the transmitter. Stored faults are: Reflection Fail. Resetting stored faults can cause automatic redundancy functions, which are currently in the switched-over state, to switch back to their original preselected state.		Operation

Program

The currently active program 1 can be switched off using the "Program 1 – ON/OFF" button.

4.1.4 N+1 Redundancy

The task of the N+1 automatic function is to provide a B standby transmitter for up to eight A transmitters. This B transmitter takes over the program of an A transmitter if an A transmitter signals a fault. The output of the B transmitter is normally connected to a dummy antenna. The B transmitter is connected to an antenna by the N+1 automatic function as soon as the B transmitter takes over the program of the A transmitter.

4.1.4.1 Manual Switchover

Manual switchover of a program from an A transmitter to the B transmitter is performed by connecting the A transmitter concerned to the dummy antenna (button: To Load on the corresponding A transmitter). As a result of this switchover, a) the A transmitter becomes the standby transmitter for the B transmitter and b) the B transmitter is now no longer available as the standby transmitter for other A transmitters (exception: priority control).

4.1.4.2 Automatic Switchover

If the N+1 automatic function is active and ready for operation and the A transmitter is available for the N+1 automatic function, a fault in the A transmitter causes the program to switch over to the B transmitter. The N+1 automatic function signals the switchover by changing its status to "changed". The user can now either acknowledge the switchover by pressing the "Accept changeover" key and adopt it as the new operating state, or attempt by pressing the "Reset Faults" key to reset the N+1 automatic function to the original state and to delete the fault which caused the switchover.

4.1.4.3 Configuring N+1 Automatic Function

The switching behavior of the N+1 automatic function with regard to checkout times and automatic switchback can be configured according to individual requirements. Furthermore, for the B transmitter it is possible to define the A transmitter from which the program settings are to be adopted when the B transmitter operates as a standby transmitter.

Configuring Program-Specific Settings

The B transmitter must store all program-specific settings of all A transmitters internally so that they can be activated immediately in the event of a fault. Program-specific settings are all settings which directly affect the signal path through the transmitter, i.e. settings for the coder, the exciter inputs and outputs, the transmit frequency and the output power. The program-specific settings are made at the A transmitters and stored using the menu item "Save Preset" in the Task View of the A transmitter. The settings

stored for the A transmitters are synchronized with the B transmitter automatically even if the B transmitter was switched off when the settings were stored. If the program-specific settings are changed at A transmitters without these settings being stored as presets, the changes will not be available on the B transmitter in the event of a switchover. Presets can only be stored on the A transmitters.

Configuring Power-Specific Settings

All settings which have been stored on an A transmitter as presets and synchronized with the B transmitter can be overwritten individually in the B transmitter. This can be used to calibrate the power test points of the B transmitter to the frequency and output power of the respective A transmitter. To do so, the "Program Settings" of the A transmitter concerned must be activated in the B transmitter ("*Load Program Settings*") and then the corresponding settings must be made in the menus of the B transmitter. Finally, the changed settings must be stored in the B transmitter ("*Save Tx B Settings*"). This must be repeated for all programs that the B transmitter can take over.

Settings that have been changed directly at the B transmitter are no longer synchronized with the B transmitter using the "Save Preset" function on the A transmitters. It is therefore recommended to overwrite the preset settings of the A transmitters at the B transmitter only for purposes of calibrating the power test points, and never to make program-specific settings directly at the B transmitter.

If a setting has been inadvertently changed on the B transmitter and stored for an A transmitter, automatic synchronization can be reactivated for this setting value in the following way:

- On the B transmitter, set the setting value to the same value as on the A transmitter.
- Press "*Save Tx B Settings*" in the menu of the N+1 automatic function

This setting value is now synchronized again together with all program-specific setting values of the A transmitter.

"N+1 Automatic" parameters

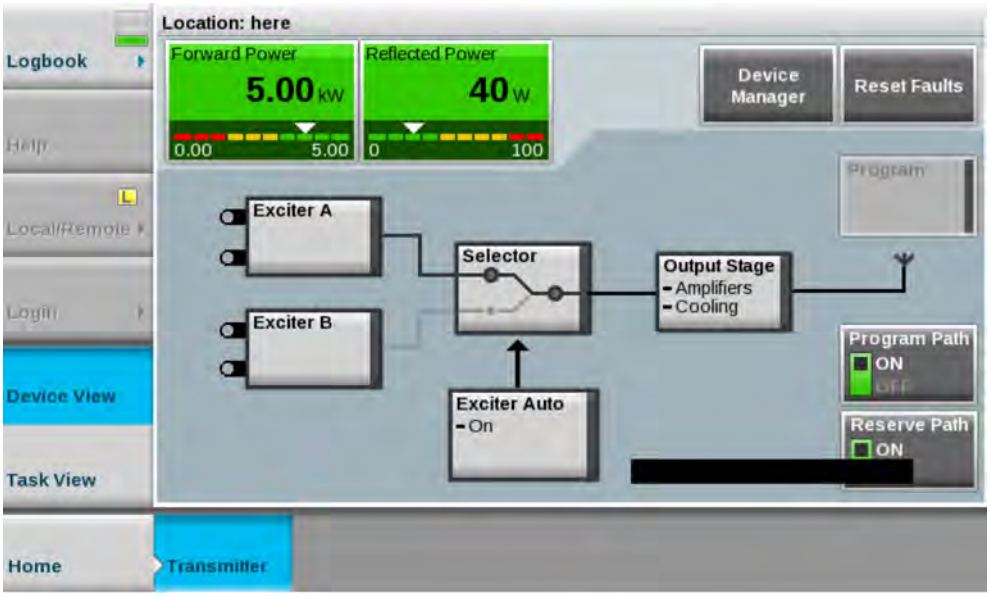
- **Path:** "Device View (Home)" > "Automatic" > "n+1 Automatic"

Name	Description	Value range	Access right
Automatic (Auto Switch)	Used to activate the n+1 automatic function. If the n+1 automatic function is active, a fault within an A transmitter causes a switchover and the program of the A transmitter is taken over by the standby B transmitter.	On, Off	Read / Write (Operation)
Guard Time (Auto Switch)	Checkout time which must pass before an A transmitter is replaced by the standby B transmitter. A long Guard Time suppresses switchover operations caused by brief faults, but also reduces the availability of the program.	0 s to 60 s	Read / Write (Maintenance)

Name	Description	Value range	Access right
Switch Mode (Auto Switch)	Used to define the switching behavior of the N+1 automatic function. Single switch: Switchover of an A transmitter to the B transmitter can occur once only. Multiple switch: Following a switchover operation, the system can switch back to the A transmitter automatically when the A transmitter no longer signals a fault but the B transmitter indicates a fault. If priority control is active, this switch should be set to Multiple Switch.	Single, Multiple	Read / Write (Maintenance)
Load Program Settings (Auto Switch)	Used to load the program-specific settings of an A transmitter to the B transmitter.	Tx A1, Tx A2, Tx A3, Tx A4, Tx A5, Tx A6, Tx A7, Tx A8	Read / Write
Save Tx B Settings (Auto Switch)	Used to save settings, which have been changed relative to the loaded A transmitter, in the B transmitter.		
Automatic (Status)	Indicates the status of the N+1 automatic function by means of three elements. If the N+1 automatic function is on, it can be "ready"/"not ready" and at the same time "changed"/"not changed".	On, Off, Ready, Not Ready, Changed	Read Only
Tx B is Reserve for (Status)	If a switchover operation has taken place, this indicates which program of an A transmitter the B transmitter has taken over.	Tx A1, Tx A2, Tx A3, Tx A4, Tx A5, Tx A6, Tx A7, Tx A8	Read Only
RF Switch (Status)	Indicates a fault if in the event of a switchover one of the RF switches could not be turned correctly or if one of the jumpers has not been positioned correctly on the patch panel (if used).	Ready / Not Ready	Read Only

4.2 Transmitter

The screenshot below shows the Transmitter menu view. It represents the single transmitter level. The function of the individual buttons and the meaning of specific parameters are explained in the following chapters.



4.2.1 Automatic Switchover

4.2.1.1 Automatic Input Signal

The R&S®TCE900 in the R&S®TCE900 exciter configuration has an automatic switchover function which, in the event of a signal failure at one logical input, switches over to the other logical input (provided that a valid input signal is available at the other logical input). Before a failure occurs, the preselected input is active. The way in which this automatic switchover function operates is determined by the following factors:

Automatic input switchover ON/OFF

If automatic switchover is OFF, the preselected input remains active even if the input signal fails. If automatic switchover is ON and there is a failure at the (preselected) input, switchover to the standby input takes place.

Input priority (Preferred Input = Logical Input 1/2)

Following switchover of the priority logical input to the standby input, the automatic system switches back to this priority input as soon as a signal returns. All switchover operations are delayed for the set delay times. If the signal fails at both the operating input and the standby input, the priority input always remains active.

Inputs with equal priority (Preferred Input = none)

Following switchover of the active logical input, the second input with the same priority remains active until the input signal fails on this input also. The automatic system switches back to the preselected input, but only if a signal is present on it once again (and if "Switch to" is set to "reserve & back"). All switchover operations are delayed for the set delay times.

Selecting this operating mode minimizes the number of switchover operations and, in certain cases, the number of breaks in transmission.

Direction of switchover (Switch to)

The "to reserve and back" switch position enables switchover in both directions, i.e. to and from the standby input, depending on which of the two logical inputs is currently faulty.

The "reserve" switch position ensures that switchover takes place once only. Following switchover, the automatic system switches to "switched" and the "Active" indicator disappears.

Switchback to the preselected input takes place when the active input is switched over by pressing the input selector switch (Selector) and then selecting the preselected input.

If the switch is set to "reserve", the switchback to the preselected input is suppressed.

Manual switchover between inputs

The input can be switched over in the "Home" > "Transmitter" > "Exciter" menu by pressing the input selector switch ("Selector") and then selecting the desired input.

Depending on the configuration and switching state (ON/OFF) of the automatic input signal switchover function, this menu contains either the switch used to change the preferred input or the switch used to switch over the active input.

The automatic input signal switchover function is configured in the following way:

1. Navigate to the following destination using the menu bar:
   "Devices" > "Tx<n>" > "Exciter A|B" > "Input Auto"
2. The following parameters must be defined on the **Automatic** tab:
   a) for Configuration:
      - *Automatic:*
      - *Preferred Input:*
      - *Guard Time to Reserve:*
      - *Guard Time Back:*
      - *Switch to:*
   b) for Reserve Control:
      - *If Reserve Input Fails.*
   c) for Seamless Switching:
      - *Seamless Switching:*
      - *Delay between Inputs*
      - *Pre-Delay:*

d) for Input Control:

- *Force Exciter Changeover:*
- *Mute on Input Fail*
- *If Reserve Input fails*

"Automatic input signal switchover" parameters

Name	Description	Value range	Access right
Automatic (State)	Indicates the state of the automatic input signal switchover function. ● Not Ready: The automatic switchover function is not ready. An input signal is not present at the standby input or a switchover has already taken place and the automatic switchover function is configured such that automatic switchback is not permitted. ● Ready: The automatic switchover function is ready to switch the currently active input over to the input currently not in use as soon as the input signal of the currently active input fails. ● Changed: The automatic switchover function has switched over from the preferred input to the standby input.	undefined, Not Ready, Ready, Changed+Ready, Changed+Not Ready	Read only
Seamless Switching	Indicates whether seamless switching of the input signal is possible. "Not Possible" always appears if only one input signal is supplied or in cases where two different data streams are present at the two inputs. If seamless switching is possible, it always takes place immediately when required, regardless of whether a "Guard Time to Reserve" or "Guard Time Back" has been set.	undefined, not Possible, Possible	Read only
Automatic	Activates automatic switchover of the input signal to the standby input if the preferred input fails.	Off, On	Operation
Preferred Input	Used to select the preferred input which the automatic input signal switchover function should use whenever possible.	Input 1, Input 2, No Preference	Operation
Active Input	Used to select the active input to be used when the automatic input signal switchover function is off. If the automatic switchover function is on, the input can only be switched over using this switch if Preferred Input is set to "No Preference" or a switchover to the standby input has taken place.	Input 1, Input 2	Operation
Switch to	Used to set the operational response of the automatic switchover function. ● "To Reserve Only": The automatic switchover function switches over once from the preferred input to the standby input and then assumes the "not ready" state". Switching the active input over manually to the preferred input reactivates the automatic switchover function. ● "To Reserve and Back": Following successful switchover to the standby input, the automatic switchover function can also switch back automatically if the signal at the standby input fails.	Reserve Only, Reserve & Back	Maintenance
Guard Time to Reserve	Used to set a guard time which must elapse before the automatic switchover function switches over to the standby input if the input signal at the preferred input fails. The set guard time has no effect if seamless switching is possible. In this case, the switchover always takes place immediately without interruption (i.e. seamlessly).		Maintenance

Name	Description	Value range	Access right
Guard Time Back	Used to set a guard time which must elapse before the automatic switchover function switches back to the preferred input if the input signal at the standby input fails. If seamless switching is possible, switchover always takes place immediately without interruption regardless of the set guard time. If "to Reserve Only" was selected as the "Direction", the set guard time has no effect.		Maintenance
If Reserve Fails	Used to determine whether the signal at the standby input is to be monitored. ● If the transmitter is operated with only one input signal or the standby input is connected only temporarily, "Do Not Show Warning" must be selected. ● If two redundant input signals are normally supplied to the transmitter, "Show Warning" must be selected.	Do Not Show Warning, Show Warning	Maintenance

4.2.1.2 Automatic Exciter Switchover

The automatic exciter switchover function enables a faulty exciter to be automatically switched over to a functional standby exciter.

In the "Exciter Automatic" menu it is possible to switch automatic switchover between two exciters on and off and to select the basic operating behavior of the function. The "Switch Mode" switch is used to select whether automatic switchover to a standby exciter is to take place once only (Single Switch) or whether a switchback is also to be performed if the standby exciter signals a fault, but the preselected exciter is no longer faulty (Multiple Switch).

It is also possible to set a guard time which must always expire before a switchover can take place. This prevents unwanted switchover operations resulting from brief fault events.

Operation

One of the two exciters can be preselected for operation by pressing the exciter selector switch (or via the ExciterAuto -> Exciter Switch tab). This exciter is switched on together with the output stage by pressing the "Program Path On" switch (in the "Transmitter" menu). If necessary, the RF of the standby exciter can be switched on for measuring and monitoring purposes by pressing the "Reserve Path (on)" switch (in the "Transmitter" menu). A switchover operation causes the standby exciter to become the main exciter and vice versa. The ON/OFF switches then act on the other exciter in each case.

"Single Switch" Mode

If a fault occurs in the preselected exciter, the automatic switchover function will swap the main and standby exciter and display an "Automatic changed" message.

Either the new state can now be accepted by changing the "preselected exciter" ("Automatic changed" disappears) or the automatic switchover function can be reset to its original state by pressing "Reset Faults" (in the "Transmitter" menu).

"Multiple Switch" Mode

This mode is identical to "Single Switch", except that following a double switchover operation the "preselected" exciter becomes the active exciter again. The "Automatic Changed" message is still displayed in this case. To delete this message, either the new state of the automatic switchover can be adopted by pressing the "Recommand Selection" button (in the "Transmitter" > "Exciter Auto" menu, "Exciter Switch" tab) or the original state can be assumed again by pressing "Reset Faults" (in the Transmitter menu).

4.2.2 Transmitter Status

Name	Description	Value range	Access right
Program On	Indicates whether all components in the program path of the transmitter have been switched on or off (reserve exciter with "Dual Drive" redundancy concept and reserve output stage with "active PA reserve" redundancy concept).	Off; On	Read Only
Reserve On	Indicates whether all components in the reserve path of the transmitter have been switched on or off (reserve exciter with "Dual Drive" redundancy concept and reserve output stage with "active PA reserve" redundancy concept).	Off; On	Read Only
Overall LED		Gray: Off Green: OK Yellow: Warning Red: Fault	Read Only
RF LED		Gray: Off Green: OK Yellow: Warning Red: Fault	Read Only
Reflection LED		Gray: Off Yellow: Warning Red: Fault	Read Only
Automatic (Backup Drive / Dual Drive)	Indicates whether the automatic exciter switchover function has been activated. If the automatic switchover function is active, the system will switch over to the standby exciter if the active exciter fails.	Off; On	Read Only
Ready (Backup Drive / Dual Drive)	Indicates whether the automatic exciter switchover function is ready. If "not ready" is indicated, either the automatic exciter switchover function has already switched over to the standby exciter or a fault has occurred in the exciter switch.	Yes; No	Read Only
changed Over (Backup Drive / Dual Drive)	Indicates whether the automatic exciter switchover function has switched over to a reserve exciter.		Read Only
switch Failed (Backup Drive / Dual Drive)	Indicates that switchover to the reserve exciter has failed.		Read Only

4.2.3 Amplifiers

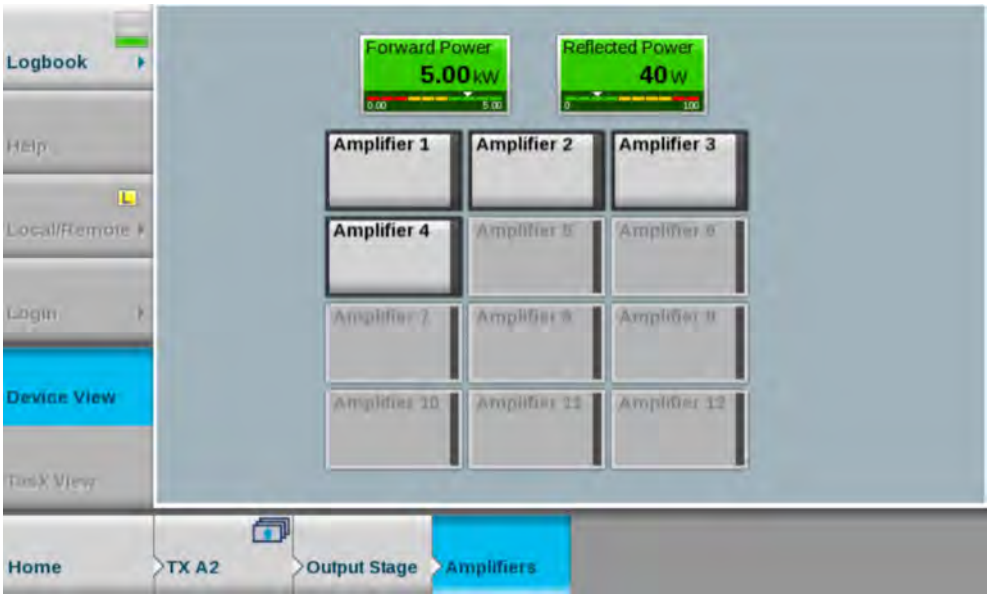


Fig. 4-2: "Amplifiers" menu view (Multi-Tx)

R&S PHU901/R&S PHU902/R&S PHV902: "Status" parameters

- **Path:** *"Device View (Home)" > "Tx <n>" > "Output Stage" > "Amplifiers" > "Amplifier <n>" > Tab "Status"*

Name	Description	Value range	Access right
Amplifier	Indicates whether the amplifier has been switched on or off by the R&S TCE900 Tx control.	Off, On	Read only
Link	Indicates the status of the communication link between the amplifier and the R&S TCE900 Tx control. The status is indicated as follows: ● Ok A link exists between the amplifier and the R&S TCE900 Tx control. ● Warning No link exists between the amplifier and the R&S TCE900 Tx control. Check the power supply of the amplifier.	Ok, Warning	Read only
RF In Fail	Indicates that the amplifier is receiving an input signal, the level of which is too low. ● If this message occurs at all amplifiers at the same time, the fault is located at the exciter switch, splitter or exciter. ● If this fault occurs at only some of the amplifiers, the output level of the exciters and splitter must be checked. ● If the fault occurs at only one amplifier, the self-engaging connector of the RF signal on the rear panel of the amplifier must be checked for mechanical damage.	No, Yes (warning)	Read only

Name	Description	Value range	Access right
Mute	Indicates that the amplifier is suppressing its output signal. This indicator appears in the following cases: ● No input signal is present ● During bias adjustment ● An external absorber signals via connector X11 that it is overheating.	No, Yes (warning)	Read only
Init Fail	Indicates a fault if the amplifier detects an internal fault at power ON. If other faults are indicated at the same time, the cause of these faults must be rectified first. If the "Init Fail" fault still exists after other faults have been rectified, the amplifier must be replaced.	No, Yes (fault)	Read only
Reflection	Indicates whether the reflection at the RF output is becoming too great. In this case, the antenna as well as the link between the amplifiers and the antenna via the coupling switches and output stage switches (if present) must be checked. The occurrence of reflection is stored in a nonvolatile memory. After the reason for the reflection has been rectified, this message must be reset manually by pressing the "Reset Faults Transmitter" button or "Reset Faults System" button.	No, Yes (warning)	Read only
RF Power Fail	Indicates that the output power of the amplifier is more than 3 dB below the nominal value.	No, Yes (fault)	Read only
Temp. Fail	Indicates that the amplifier has overheated internally. The shut-off taps for the coolant must be checked. They must be open. The occurrence of this message is stored in a nonvolatile memory. After the reason for the overheating has been rectified, this message must be reset manually by pressing the "Reset Faults Transmitter" button or "Reset Faults System" button.	No, Yes (fault)	Read only
Transistor Fail	Indicates that one or more driver or power transistors are defective. **NOTE:** Only personnel with the relevant special service training are permitted to change the transistors.	No, Yes (fault)	Read only
BIAS Fail	Indicates a fault if the quiescent current of one or more transistors cannot be adjusted. ● "No Error": Automatic quiescent current adjustment has been performed properly. ● Abort Adjust: Adjustment has been aborted because a constant temperature has not settled in the amplifier. In this case, adjustment should be started again immediately after the fault has occurred. ● "Error on PA On" or "Adjust Error": There is a technical fault in the amplifier; the amplifier should be replaced.	No Error, Abort Adjust, Error on PA On, Adjust Error	Read only
Doherty Active	Indicates whether the Doherty mode of the amplifier is active or not (**not** valid for R&S TCE900).	Off, On	Read only

Name	Description	Value range	Access right
Freq. ID	**With R&S PHU902 only:** Indicates the frequency ranges in which the amplifier can be operated in Doherty mode. B2: 575 MHz to 660 MHz B4: 470 MHz to 500 MHz; 660 MHz to 715 MHz B5: 500 MHz to 530 MHz; 715 MHz to 750 MHz B6: 530 MHz to 575 MHz; 750 MHz to 790 MHz If the option is not suitable for the transmit frequency, the amplifier automatically switches to broadband mode. **With R&S PHV902 only:** Indicates the frequency ranges in which the amplifier can be operated in Doherty mode. D1: 170 MHz to 179 MHz D2: 179 MHz to 193 MHz; 224 MHz to 239 MHz D3: 193 MHz to 207 MHz; 239 MHz to 254 MHz D4: 207 MHz to 224 MHz BB: Amplifier can only be operated in the broadband mode. If the option is not suitable for the transmit frequency, the amplifier automatically switches to broadband mode.	String	Read Only
Regulation Fail	Indicates that the internal power regulation of the amplifier has reached the limit of its control range. This is an indication that one or more power transistors are defective.	No, Yes (fault)	Read only
Amplifier Temp.	Indicates the temperature of the amplifier. The amplifier temperature is usually a few degrees higher than the coolant temperature. If it is more than 15 °C higher, either the shut-off taps for the coolant are closed or the flow rate of the coolant is too low (chapter 4.12, "Cooling System", on page 210).	0 °C to 150 °C	Read only
Absorber Fail	Indicates that overheating of the rack absorber has been detected. Normally, this warning is signaled by all amplifiers of a transmitter simultaneously. If the warning is signaled by only one amplifier, check the rack cabling.	No, Yes (warning)	Read only
Coolant Temp.	Indicates the temperature of the coolant flowing out of the transmitter rack toward the heat exchanger. The temperature must not exceed a maximum value of 65 °C.		Read only
RF Monitor	Indicates the coupling attenuation of the "RF Monitor" test point on the amplifier at 205.5 MHz (VHF amplifier) resp. 650 MHz (UHF amplifier).	0.00 dB to +99.99 dB	Read only
AC Fail	Indicates a fault if the mains voltage has been interrupted. The circuit breakers must be checked in this case.	No, Yes (warning)	Read only
DC Fail	Indicates whether one of the internal power supply units of the amplifier is not delivering DC voltage. Detection of a fault is only possible if the RF of the transmitter has been switched on (Program on).	No, Yes (fault)	Read only
Supply Fail	Indicates that one of the internal power supply units is probably not working.	No, Yes (fault)	Read only

R&S PHR901 (VHF, Band II): "Status" parameters

- **Path:** *"Device View (Home)" > "Tx <n>" > "Output Stage" > "Amplifiers" > "Amplifier <n>" > Tab "Status"*

Name	Beschreibung	Wertebereich	Zugriffsrecht
Amplifier	Indicates whether the amplifier has been switched on or off by the R&S TCE900.	Off, On	Read Only
Mute	Indicates that the amplifier is suppressing its output signal. This indicator appears in the following cases: ● No input signal is present ● During bias adjustment ● An external absorber signals via connector X11 that it is overheating.	No, Yes (warning)	Read only
RF Power Fail	Indicates that the output power of the amplifier is more than 3 dB below the nominal value.	No, Yes (Fault)	Read Only
Temp. Fail	Indicates that the amplifier has overheated internally. The shut-off taps for the coolant must be checked. They must be open. The occurrence of this message is stored in a nonvolatile memory. After the reason for the overheating has been rectified, this message must be reset manually by pressing the "Reset Faults Transmitter" button or "Reset Faults System" button.	No, Yes (fault)	Read only
Supply Fail	Indicates that one of the internal power supply units is probably not working.	No, Yes (Fault)	Read Only
Link	Indicates whether a communication link exists between the amplifier and the R&S TCE900 Tx control. If no link exists between the amplifier and the R&S TCE900 Tx control, check the power supply of the amplifier.	On, Off	Read Only
Regulation Fail	Indicates that the internal power regulation of the amplifier has reached the limit of its control range. This is an indication that one or more power transistors are defective. This fault can also occur if the amplifier performs a system check following a TRANSISTOR_FAIL and then continues to run at reduced power.	No, Yes (Fault)	Read Only
RF In Fail	Indicates that the amplifier is receiving an input signal, the level of which is too low. ● If this message occurs at all amplifiers at the same time, the fault is located at the exciter switch, splitter or exciter. ● If this fault occurs at only some of the amplifiers, the output level of the exciters and splitter must be checked. ● If the fault occurs at only one amplifier, the self-engaging connector of the RF signal on the rear panel of the amplifier must be checked for mechanical damage.	No, Yes (Warning)	Read Only
Amplifier Temp.	Indicates the temperature of the amplifier. The amplifier should only be switched on at temperatures above 0 °C.	0 °C to 150 °C	Read Only
AC Fail	Indicates a fault if the mains voltage has been interrupted. The circuit breakers must be checked in this case.	No, Yes (Warning)	Read Only
DC Fail	Indicates whether one of the internal power supply units of the amplifier is faulty (e.g. no DC voltage is being delivered). Detection of a fault is only possible if the RF of the transmitter has been switched on (Program on).	No, Yes (Fault)	Read Only

Name	Beschreibung	Wertebereich	Zugriffsrecht
Init Fail	Indicates a fault if the amplifier detects an internal fault at power ON. If other faults are indicated at the same time, the cause of these faults must be rectified first. If the "Init Fail" fault still exists after other faults have been rectified, the amplifier must be replaced.	No, Yes (Fault)	Read Only
Reflection	Indicates whether the reflection at the RF output is becoming too great. In this case, the antenna as well as the link between the amplifiers and the antenna via the combiners and output stage switches (if present) must be checked. The occurrence of reflection is stored in a nonvolatile memory. After the reason for the reflection has been rectified, this message must be reset manually by pressing the "Reset Faults Transmitter" button or "Reset Faults System" button.	No, Yes (Warning)	Read Only
Coolant Temp.	Indicates the temperature of the coolant. The coolant temperature is usually a few degrees lower than the amplifier temperature.	0 °C to approx. 150 °C	
AC 1	Indicates that the AC voltage of power supply unit 1 is in the permissible range.	No, Yes	Read Only
DC 1	Indicates whether the DC voltage of power supply unit 1 is in the permissible range. This message is only output if an ON command has been issued and the AC voltage is present at power supply unit 1.	No, Yes (Fault)	Read Only
Transistor Fail	Indicates that one or more driver or power transistors are defective. **NOTE:** Only personnel with the relevant special service training are permitted to change the transistors.	No, Yes	Read Only
Absorber Fail	Indicates that overheating of the rack absorber has been detected. Normally, this warning is signaled by all amplifiers of a transmitter simultaneously. If the warning is signaled by only one amplifier, check the rack cabling.	No, Yes (Fault)	Read Only
AC 2	Indicates that the AC voltage of power supply unit 2 is in the permissible range.	No, Yes	Read Only
DC 2	Indicates whether the DC voltage of power supply unit 2 is in the permissible range. This message is only output if an ON command has been issued and the AC voltage is present at power supply unit 2.	No, Yes (Fault)	Read Only
BIAS Fail	Indicates a fault if the quiescent current of one or more transistors cannot be adjusted. ● "No Error": Automatic quiescent current adjustment has been performed properly. ● Abort Adjust: Adjustment has been aborted because a constant temperature has not settled in the amplifier. In this case, adjustment should be started again immediately after the fault has occurred. ● "Error on PA On" or "Adjust Error": There is a technical fault in the amplifier; the amplifier should be replaced.	No Error, Abort Adjust, Error on PA On, Adjust Error	Read only
RF Monitor	Indicates the coupling attenuation of the "RF Monitor" RF test point on the amplifier (87.5 MHz to 108 MHz).	52,6 dB to 58,6 dB	Read Only

Name	Beschreibung	Wertebereich	Zugriffsrecht
AC 3	Indicates that the AC voltage of power supply unit 3 is in the permissible range.	No, Yes	Read Only
DC 3	Indicates whether the DC voltage of power supply unit 3 is in the permissible range. This message is only output if an ON command has been issued and the AC voltage is present at power supply unit 3.	No, Yes (Fault)	Read Only

R&S PMU901: "Status" parameters

- **Path:** *"Device View (Home)" > "Tx <n>" > "Output Stage" > "Amplifiers" > "Amplifier <n>" > Tab "Status"*

Name	Description	Value range	Access right
Amplifier	Indicates whether the amplifier has been switched on or off by the R&S TCE900.	Off, On	Read only
Link	Indicates the status of the communication link between the amplifier and the R&S TCE900 Tx control. The status is indicated as follows: ● OK A link exists between the amplifier and the R&S TCE900 Tx control. ● Warning No link exists between the amplifier and the R&S TCE900 Tx control. Check the power supply of the amplifier.	Ok, Warning	Read only
RF In Fail	Indicates that the amplifier is receiving an input signal, the level of which is too low. ● If this message occurs at all amplifiers at the same time, the fault is located at the exciter switch, splitter or exciter. ● If this fault occurs at only some of the amplifiers, the output level of the exciters and splitter must be checked. ● If the fault occurs at only one amplifier, the self-engaging connector of the RF signal on the rear panel of the amplifier must be checked for mechanical damage.	No, Yes (warning)	Read only
Mute	Indicates that the amplifier is suppressing its output signal. This indicator appears in the following cases: ● No input signal ● During bias adjustment ● An external absorber signals via connector X11 that it is overheating.	No, Yes (warning)	Read only
Init Fail	Indicates a fault if the amplifier detects an internal fault at power ON. If other faults are indicated at the same time, the cause of these faults must be rectified first. If the "Init Fail" fault still exists after other faults have been rectified, the amplifier must be replaced.	No, Yes (fault)	Read only
RF Monitor	Indicates the coupling attenuation of the "RF Monitor" test point on the amplifier at 650 MHz.	0.00 dB to +99.99 dB	Read only

Name	Description	Value range	Access right
Reflection	Indicates whether the reflection at the RF output is becoming too great. In this case, the antenna as well as the link between the amplifiers and the antenna via the combiners and output stage switches (if present) must be checked. The occurrence of reflection is stored in a nonvolatile memory. After the reason for the reflection has been rectified, this message must be reset manually by pressing the "Reset Faults Transmitter" button or "Reset Faults System" button.	No, Yes (warning)	Read only
RF Power Fail	Indicates that the output power of the amplifier is more than 3 dB below the nominal value.	No, Yes (fault)	Read only
Temp. Fail	Indicates that the amplifier has overheated internally. The shut-off taps for the coolant must be checked. They must be open. The occurrence of this message is stored in a nonvolatile memory. After the reason for the overheating has been rectified, this message must be reset manually by pressing the "Reset Faults Transmitter" button or "Reset Faults System" button.	No, Yes (fault)	Read only
Transistor Fail	Indicates that one or more driver or power transistors are defective. **NOTE:** Only personnel with the relevant special service training are permitted to change the transistors.	No, Yes	Read only
BIAS Fail	Indicates a fault if the quiescent current of one or more transistors cannot be adjusted. ● "No Error": Automatic quiescent current adjustment has been performed properly. ● Abort Adjust: Adjustment has been aborted because a constant temperature has not settled in the amplifier. In this case, adjustment should be started again immediately after the fault has occurred. ● "Error on PA On" or "Adjust Error": There is a technical fault in the amplifier; the amplifier should be replaced.	No Error, Abort Adjust, Error on PA On, Adjust Error	Read only
Amplifier Temp.	Indicates the temperature of the amplifier. The amplifier should only be switched on at temperatures above 0 °C.	−30 °C to 120 °C	Read only
Frequency Fail	This fault occurs if the tunit (tuning unit) used in the amplifier is not suitable for the RF of the exciter. The tunit is a plug-in module and is on the top side of the amplifier. Please check that the used tunit is suitable for the frequency which is set in the Output menu of the exciter, and whether it has been installed in the amplifier in the "Doherty" or "Broadband" position corresponding to the setting in the "Basic Config" menu.	No, Yes (fault)	Read only

Name	Description	Value range	Access right
Freq. ID	Shows the ID of the tunit (tuning unit) which is installed in the amplifier. The operating frequency which is set for the transmitter, and the resulting center frequency of the operating channel must be suitable for the operating frequency range of the tunit. The ID "BB" is shown if the tunit is fitted in the position (slot) "BB" (= broadband mode). "Missmatch" is shown if no tunit is built in. 1: 502 MHz to 518 MHz; 614 MHz to 630 MHz; 750 MHz to 758 MHz 2: 470 MHz to 486 MHz; 574 MHz to 598 MHz; 710 MHz to 726 MHz; 830 MHz to 854 MHz 3: 558 MHz to 574 MHz; 686 MHz to 710 MHz; 814 MHz to 830 MHz 4: 550 MHz to 558 MHz; 670 MHz to 686 MHz; 790 MHz to 814 MHz 5: 534 MHz to 550 MHz; 646 MHz to 670 MHz; 774 MHz to 790 MHz 6: 518 MHz to 534 MHz; 630 MHz to 646 MHz; 758 MHz to 774 MHz 7: 486 MHz to 502 MHz; 598 MHz to 614 MHz; 726 MHz to 750 MHz; 854 MHz to 862 MHz	1 to 7, BB, mismatch	Read only
Regulation Fail	Indicates that the internal power regulation of the amplifier has reached the limit of its control range. This is an indication that one or more power transistors are defective. This fault can also occur if the amplifier performs a system check following a TRANSISTOR_FAIL and then continues to run at reduced power.	No, Yes (fault)	Read only
Blower Fail	Indicates a fault if one of the fans of the amplifier module has failed.	No, Yes (fault)	Read only
Absorber Fail	Indicates that overheating of the rack absorber has been detected. Normally, this warning is signaled by all amplifiers of a transmitter simultaneously. If the warning is signaled by only one amplifier, check the rack cabling.	No, Yes (fault)	Read only
Air Inlet	Indicates the inlet air temperature of the amplifier module. It should always be in the range +1 °C to +45 °C.	−30 °C to +120 °C	Read only
AC Fail	Indicates a fault if the mains voltage has been interrupted. The circuit breakers must be checked in this case.	No, Yes (warning)	Read only
AC 1 Ok	Indicates that the mains AC voltage at power supply unit 1 is in the permissible range **(only valid for PMU901 with power supply standby).**	No, Yes	
AC 2 Ok	Indicates that the mains AC voltage at power supply unit 2 is in the permissible range **(only valid for PMU901 with power supply standby).**	No, Yes	
DC Fail	Indicates whether one of the internal power supply units of the amplifier is faulty (e.g. no DC voltage is being delivered). Detection of a fault is only possible if the RF of the transmitter has been switched on (Program on).	No, Yes (fault)	Read only
DC 1 Ok	Indicates whether the DC voltage of power supply unit 1 is in the permissible range. This message is only output if an ON command has been issued and the AC voltage is present at power supply unit 1 **(only valid for PMU901 with power supply standby).**	No, Yes (fault)	Read only

Name	Description	Value range	Access right
DC 2 Ok	Indicates whether the DC voltage of power supply unit 2 is in the permissible range. This message is only output if an ON command has been issued and the AC voltage is present at power supply unit 2 **(only valid for PMU901 with power supply standby).**	No, Yes (fault)	Read only
Supply Fail	Indicates that one of the internal power supply units is probably not working.	No, Yes (fault)	Read only
Supply 1 Fail	Indicates that power supply unit 1 (right) is probably faulty **(only valid for PMU901 with power supply standby).**	No, Yes (fault)	Read only
Supply 2 Fail	Indicates that power supply unit 2 (left) is probably faulty **(only valid for PMU901 with power supply standby).**	No, Yes (fault)	Read only
Air Outlet	Indicates the outlet air temperature of the amplifier module.	−30 °C to +120 °C	Read only

R&S PMV901: "Status" parameters

- **Path:** *"Device View (Home)" > "Tx <n>" > "Output Stage" > "Amplifiers" > "Amplifier <n>" > Tab "Status"*

Name	Description	Value range	Access right
Amplifier	Indicates whether the amplifier has been switched on or off by the R&S TCE900 Tx control.	Off, On	Read only
Link	Indicates the status of the communication link between the amplifier and the R&S TCE900 Tx control. The status is indicated as follows: ● OK A link exists between the amplifier and the R&S TCE900 Tx control. ● Warning No link exists between the amplifier and the R&S TCE900 Tx control. Check the power supply of the amplifier.	Ok, Warning	Read only
RF In Fail	Indicates that the amplifier is receiving an input signal, the level of which is too low. ● If this message occurs at all amplifiers at the same time, the fault is located at the exciter switch, splitter or exciter. ● If this fault occurs at only some of the amplifiers, the output level of the exciters and splitter must be checked. ● If the fault occurs at only one amplifier, the self-engaging connector of the RF signal on the rear panel of the amplifier must be checked for mechanical damage.	No, Yes (warning)	Read only
Mute	Indicates that the amplifier is suppressing its output signal. This indicator appears in the following cases: ● No input signal ● During bias adjustment ● An external absorber signals via connector X11 that it is overheating.	No, Yes (warning)	Read only
Init Fail	Indicates a fault if the amplifier detects an internal fault at power ON. If other faults are indicated at the same time, the cause of these faults must be rectified first. If the "Init Fail" fault still exists after other faults have been rectified, the amplifier must be replaced.	No, Yes (fault)	Read only

Name	Description	Value range	Access right
RF Monitor	Indicates the coupling attenuation of the "RF Monitor" test point on the amplifier at 650 MHz.	0.00 dB to +99.99 dB	Read only
Reflection	Indicates whether the reflection at the RF output is becoming too great. In this case, the antenna as well as the link between the amplifiers and the antenna via the combiners and output stage switches (if present) must be checked. The occurrence of reflection is stored in a nonvolatile memory. After the reason for the reflection has been rectified, this message must be reset manually by pressing the "Reset Faults Transmitter" button or "Reset Faults System" button.	No, Yes (warning)	Read only
RF Power Fail	Indicates that the output power of the amplifier is more than 3 dB below the nominal value.	No, Yes (fault)	Read only
Temp. Fail	Indicates that the amplifier has overheated internally. The shut-off taps for the coolant must be checked. They must be open. The occurrence of this message is stored in a nonvolatile memory. After the reason for the overheating has been rectified, this message must be reset manually by pressing the "Reset Faults Transmitter" button or "Reset Faults System" button.	No, Yes (fault)	Read only
Transistor Fail	Indicates that one or more driver or power transistors are defective. **NOTE:** Only personnel with the relevant special service training are permitted to change the transistors.	No, Yes	Read only
BIAS Fail	Indicates a fault if the quiescent current of one or more transistors cannot be adjusted. ● "No Error": Automatic quiescent current adjustment has been performed properly. ● Abort Adjust: Adjustment has been aborted because a constant temperature has not settled in the amplifier. In this case, adjustment should be started again immediately after the fault has occurred. ● "Error on PA On" or "Adjust Error": There is a technical fault in the amplifier; the amplifier should be replaced.	No Error, Abort Adjust, Error on PA On, Adjust Error	Read only
Amplifier Temp.	Indicates the temperature of the amplifier. The amplifier should only be switched on at temperatures above 0 °C.	−30 °C to 120 °C	Read only
Doherty Active	Indicates whether the Doherty mode of the amplifier is active or not.	No, Yes (Fault)	Read only
Freq. ID	Indicates the frequency ranges in which the amplifier can be operated in Doherty mode. D1: 170 MHz to 179 MHz D2: 179 MHz to 193 MHz; 224 MHz to 239 MHz D3: 193 MHz to 207 MHz; 239 MHz to 254 MHz B4: 207 MHz to 224 MHz BB: Amplifier can only be operated in the broadband mode. If the option is not suitable for the transmit frequency, the amplifier automatically switches to broadband mode.	D1 to D4, BB, mismatch	Read only
Regulation Fail	Indicates that the internal power regulation of the amplifier has reached the limit of its control range. This is an indication that one or more power transistors are defective. This fault can also occur if the amplifier performs a system check following a TRANSISTOR_FAIL and then continues to run at reduced power.	No, Yes (fault)	Read only

Name	Description	Value range	Access right
Blower Fail	Indicates a fault if one of the fans of the amplifier module has failed.	No, Yes (fault)	Read only
Absorber Fail	Indicates that overheating of the rack absorber has been detected. Normally, this warning is signaled by all amplifiers of a transmitter simultaneously. If the warning is signaled by only one amplifier, check the rack cabling.	No, Yes (fault)	Read only
Air Inlet	Indicates the inlet air temperature of the amplifier module. It should always be in the range +1 °C to +45 °C.	−30 °C to +120 °C	Read only
AC Fail	Indicates a fault if the mains voltage has been interrupted. The circuit breakers must be checked in this case.	No, Yes (warning)	Read only
AC 1 Ok	Indicates that the mains AC voltage at power supply unit 1 is in the permissible range **(only valid for PMVU901 with power supply standby).**	No, Yes	
AC 2 Ok	Indicates that the mains AC voltage at power supply unit 2 is in the permissible range **(only valid for PMV901 with power supply standby).**	No, Yes	
DC Fail	Indicates whether one of the internal power supply units of the amplifier is faulty (e.g. no DC voltage is being delivered). Detection of a fault is only possible if the RF of the transmitter has been switched on (Program on).	No, Yes (fault)	Read only
DC 1 Ok	Indicates whether the DC voltage of power supply unit 1 is in the permissible range. This message is only output if an ON command has been issued and the AC voltage is present at power supply unit 1 **(only valid for PMV901 with power supply standby).**	No, Yes (fault)	Read only
DC 2 Ok	Indicates whether the DC voltage of power supply unit 2 is in the permissible range. This message is only output if an ON command has been issued and the AC voltage is present at power supply unit 2 **(only valid for PMV901 with power supply standby).**	No, Yes (fault)	Read only
Supply Fail	Indicates that one of the internal power supply units is probably not working.	No, Yes (fault)	Read only
Supply 1 Fail	Indicates that power supply unit 1 (right) is probably faulty **(only valid for PMV901 with power supply standby).**	No, Yes (fault)	Read only
Supply 2 Fail	Indicates that power supply unit 2 (left) is probably faulty **(only valid for PMV901 with power supply standby).**	No, Yes (fault)	Read only
Air Outlet	Indicates the outlet air temperature of the amplifier module.	−30 °C to +120 °C	Read only

"Supply" parameters

- **Path:** *"Device View (Home)" > "Tx <n>" > "Output Stage" > "Amplifiers" > "Amplifier <n>" > Tab "Supply"*

Name	Description	Value range	Access right
V Aux In (Supply)	Indicates the supply voltage of the amplifier control board. This auxiliary voltage is generated directly by the power supply unit. This voltage should be present at the amplifier control board even if the amplifier has been switched off by the R&S TCE900. If no voltage is indicated, the miniature circuit breakers of the power distribution unit as well as the self-engaging contacts on the rear panel of the amplifier must be checked first of all. If no fault can be found in the energy feed, the amplifier must be replaced.		Read only
V+ Mon (Supply)	Indicates the voltage supplied to the transistor blocks by the power supply unit. If the displayed voltage is 0 V, either the power supply unit is faulty or the amplifier has not been switched on by the R&S TCE900.		Read only
I DC (Amplifier)	Indicates the total current flowing through the internal power supply units. If the display shows 0 A, the amplifier may not have been switched on by the R&S TCE900. Other possible faults are: ● RF In Fail ● Temperature Fail ● DC Fail		Read only
I Pre (Amplifier)	Indicates the current flowing through the transistors of the preamplifier module.		Read only
V5V ACB (Amplifier Control Board)	Indicates the 5 V auxiliary voltage which is generated on the amplifier control board from the auxiliary voltage (V_AUX_IN) of the power supply unit. If no voltage is indicated, the miniature circuit breakers of the energy distribution unit and also the self-engaging contacts on the rear panel of the amplifier should be checked first of all. If no fault can be found in the energy feed, the amplifier must be replaced.		Read only
V 3V5 (Amplifier Control Board)	Indicates the 3.5 V auxiliary voltage which is generated on the amplifier control board from the auxiliary voltage (V_AUX_IN) of the power supply unit. If no voltage is indicated, the miniature circuit breakers of the energy distribution unit and also the self-engaging contacts on the rear panel of the amplifier should be checked first of all. If no fault can be found in the energy feed, the amplifier must be replaced.		Read only

Name	Description	Value range	Access right
V 12 Mon (Pre Amplifier)	Indicates the 12 V auxiliary voltage. • **R&S PHU901, R&S PHU902, R&S PHV902, R&S PHR901:** The auxiliary voltage is generated on the preamplifier board from the 20 V supply voltage (V PRE MON). If the amplifier has not been switched on by the R&S TCE900 the voltage is approx. 8 V. • **R&S PMU901, R&S PMV901:** The auxiliary voltage is generated on the amplifier board from the 20 V supply voltage (V_PRE_MON). If the amplifier has not been switched on by the R&S TCE900, the voltage is 0 V.		Read only
V Pre Mon (Pre Amplifier)	Indicates the 20 V supply voltage of the preamplifier. • **R&S PHU901, R&S PHU902, R&S PHV902:** In the ON state, the voltage is approx. 20 V and is generated on the preamplifier board. The displayed voltage is 0 V if the amplifier has been switched off by the R&S TCE900. If no voltage is indicated in the ON state, the miniature circuit breakers of the energy distribution unit and also the self-engaging contacts on the rear panel of the amplifier should be checked first of all. If no fault can be found in the energy feed, the amplifier must be replaced. • **R&S PMU901:** As for PHU901, except that here the 20 V voltage is generated on the amplifier board. • **R&S PMV901:** not existing.		Read only

R&S PHU901/R&S PHU902/R&S PHV902: "Transistors" parameters

- **Path:** *"Device View (Home)" > "Tx <n>" > "Output Stage" > "Amplifiers" > "Amplifier <n>" > Tab "Transistors"*

Name	Description	Value range	Access right
I PRE	Indicates the current flowing through the transistors of the preamplifier module.	0 A to 5 A	Read only
I DRV	Indicates the current flowing through transistors V12A and V12B of the driver module.	0 A to 40 A	Read only
I 1A	Indicates the current flowing through transistors V14 and V15 of output stage module 1 in transistor block A.	0 A to 40 A	Read only
I 2A	Indicates the current flowing through transistors V16 and V17 of output stage module 2 in transistor block A.	0 A to 40 A	Read only
I 3A	Indicates the current flowing through transistors V18 and V19 of output stage module 3 in transistor block A (**not** valid for R&S PHV902).	0 A to 40 A	Read only
I 1B	Indicates the current flowing through transistors V24 and V25 of output stage module 1 in transistor block B.	0 A to 40 A	Read only
I 2B	Indicates the current flowing through transistors V26 and V27 of output stage module 2 in transistor block B.	0 A to 40 A	Read only
I 3B	Indicates the current flowing through transistors V28 and V29 of output stage module 3 in transistor block B (**not** valid for R&S PHV902)..	0 A to 40 A	Read only

R&S PHR901 (VHF, Band II): "Transistors" parameters

- **Path:** *"Device View (Home)" > "Tx <n>" > "Output Stage" > "Amplifiers" > "Amplifier <n>" > Tab "Transistors"*

Name	Description	Value range	Access right
I DRV	Indicates the current flowing through transistors T1000 and T1050 of the preamplifier/driver.	0 A to 5 A	Read only
I 101	Indicates the current flowing through transistor V101 of output stage module 1 in transistor block A.	0 A to 40 A	Read only
I 102	Indicates the current flowing through transistor V102 of output stage module 1 in transistor block A.	0 A to 40 A	Read only
I 103	Indicates the current flowing through transistor V103 of output stage module 2 in transistor block A.	0 A to 40 A	Read only
I 104	Indicates the current flowing through transistor V104 of output stage module 2 in transistor block A.	0 A to 40 A	Read only
I 105	Indicates the current flowing through transistor V105 of output stage module 3 in transistor block B.	0 A to 40 A	Read only
I 106	Indicates the current flowing through transistor V106 of output stage module 3 in transistor block B.	0 A to 40 A	Read only
I 107	Indicates the current flowing through transistor V107 of output stage module 4 in transistor block B.	0 A to 40 A	Read only
I 108	Indicates the current flowing through transistor V108 of output stage module 4 in transistor block B.	0 A to 40 A	Read only

R&S PMU901/R&S PMV901: "Transistors" parameters

- **Path:** *"Device View (Home)" > "Tx <n>" > "Output Stage" > "Amplifiers" > "Amplifier <n>" > Tab "Transistors"*

Name	Beschreibung	Wertebereich	Zugriffsrecht
I PRE	Zeigt den Strom durch die Transistoren des Vorverstärkermoduls an.	0 A bis 5 A	Read Only
I DRV	Zeigt den Strom durch den Transistor V401 an.	0 A bis 40 A	Read Only
I 1A	Zeigt den Strom durch den Transistor V500 im Transistorblock A an.	0 A bis 40 A	Read Only
I 2A	Zeigt den Strom durch den Transistor V1500 im Transistorblock A an.	0 A bis 40 A	Read Only
I 3A	Zeigt den Strom durch den Transistor V2500 im Transistorblock A an (gilt ***nicht*** für R&S PMV901).	0 A bis 40 A	Read Only
I 1B	Zeigt den Strom durch den Transistor V600 im Transistorblock B an.	0 A bis 40 A	Read Only
I 2B	Zeigt den Strom durch den Transistor V1600 im Transistorblock B an.	0 A bis 40 A	Read Only
I 3B	Zeigt den Strom durch den Transistor V2600 im Transistorblock B an (gilt ***nicht*** für R&S PMV901).	0 A bis 40 A	Read Only

R&S PHU901/R&S PHU902/R&S PHV902/R&S PMV901: "RF Levels" parameters

- **Path:** *"Device View (Home)" > "Tx <n>" > "Output Stage" > "Amplifiers" > "Amplifier <n>" > Tab "RF Levels"*

Name	Description	Value range	Access right
Power A	Indicates the measured voltage of the RF detector in transistor block A.	0 V to 8 V	Read only
Power B	Indicates the measured voltage of the RF detector in transistor block B.	0 V to 8 V	Read only
Power V Ref	Indicates the nominal value which is predefined by the R&S TCE900 for internal regulation of the output power.	0 V to 6 V	Read only
Power Out	Indicates the measured voltage of the RF detector at the output of the amplifier.	0 V to 8 V	Read only
Reflected Out	Indicates the measured voltage of the RF detector for reflected power at the output of the amplifier.	0 V to 8 V	Read only

R&S PMU901: "RF Levels" parameters

- **Path:** *"Device View (Home)" > "Tx <n>" > "Output Stage" > "Amplifiers" > "Amplifier <n>" > Tab "RF Levels"*

Name	Beschreibung	Wertebereich	Zugriffsrecht
Power V Ref	Zeigt den Sollwert an, der durch die R&S TCE900 für die interne Regelung der Ausgangsleistung vorgegeben wird.	0 V bis 6 V	Read Only
Power Out	Zeigt die gemessene Spannung des RF-Detektors am Ausgang des Verstärkers an.	0 V bis 8 V	Read Only
Reflected Out	Zeigt die gemessene Spannung des RF-Detektors für die Rücklaufleistung am Ausgang des Verstärkers an.	0 V bis 8 V	Read Only

R&S PHR901 (VHF, Band II): "RF Levels" parameters

- **Pfad:** *"Device View (Home)" > "Tx <n>" > "Output Stage" > "Amplifiers" > "Amplifier <n>" > Tab "RF Levels"*

Name	Description	Value range	Access right
Power In	Shows the measured power at the amplifier input.	0.000 W to 0.101 W	Read only
Power Driver	Shows the measured power at the amplifier driver stage.	0.0 W to 126.0 W	Read only
Power A	Indicates the measured power of the RF detector in transistor block A.	0.00 W to 10334.00 W	Read only
Power B	Indicates the measured power of the RF detector in transistor block B.	0.00 W to 10334.00 W	Read only
Power V Ref	Indicates the nominal value which is predefined by the R&S TCE900 for internal regulation of the output power.	0 % to 100.00 %	Read only
Power Out	Shows the measured power of the RF detector at the output of the amplifier.	0.00 W to 7500.00 W	Read only
Reflected Out	Shows the measured power of the RF detector for the reflected power at the output of the amplifier.	0.00 W to 1500.00 W	Read only

"Type Plate" parameters

- **Path:** *"Device View (Home)" > "Tx <n>" > "Output Stage" > "Amplifiers" > "Amplifier <n>" > Tab "Type Plate"*

Information about the amplifier is set at the factory.

Name	Description	Value range	Access right
Name	Instrument designation		Read only
Part Number	R&S material number and order number of the instrument. Specify this number when reporting faults.		Read only
Variant	Instrument variant		Read only
Product Index	Production index (parts change index)		Read only
Serial Number	Serial number		Read only
Production Date	Production date		Read only
SW/FW/Bios Number	Software, firmware or BIOS number		Read only

4.2.4 Rack

"Status Rack" parameters

Name	Description	Value range	Access right
Absorber	With multi-rack transmitters, this indicates whether one of the rack absorbers is overheating. This fault can occur if several amplifiers of a rack fail and additionally there is a fault in the cooling system.	Green: OK Red: too hot	Read Only
Cabinet Door	Indicates whether the rear rack door is open or closed **(does not apply to TMU9)**.	Green: Closed Yellow: Open	Read Only
Overvoltage Protectors	Indicates whether the overvoltage protection for the respective component is still functioning.	Green: OK Red: Fault	Read Only

4.2.5 Output Stage

"Commissioning" parameters

Name	Description	Value range	Access right
Absorber	With multi-rack transmitters, this indicates whether one of the rack absorbers is overheating. This fault can occur if several amplifiers of a rack fail and additionally there is a fault in the cooling system.	Green: OK Red: too hot	Read Only
Cabinet Door	Indicates whether the rear rack door is open or closed.	Green: Closed Yellow: Open	Read Only
external Fault	Indicates whether an external fault message exists at terminal X41 of the mains distribution board. This function is only available if the "use external faults" check mark has been set in the Commissioning dialog box for this rack.	Green: no Fault Red: Fault	Read Only
12V Control	Indicates whether a backup power supply unit connected to terminal X42 of the mains distribution board is still working. This function is only available if the "control external 12V supply" check mark has been set in the Commissioning dialog box for this rack.	Green: OK Red: Fault	Read Only
Overvoltage Protectors	Indicates whether the overvoltage protection for the respective component is still functioning.	Green: OK Red: Fault	Read Only

4.3 Exciter DVB-T2

4.3.1 Coder for DVB-T2

To operate the transmitter in DVB-T2 mode, an appropriate software option must be activated using an option kex.

This function is used to set the DVB transmission parameters required for coding and modulation and to check the used (TPS) settings (TPS = transmission parameter signaling) that are signaled during transmission.

The network configuration parameters are used to set the higher-level parameters for DVB-T2 that comply with the standard and are valid for all physical layer pipes (PLP).

The L1 frame information parameters are used to configure the "L1 post signaling".

The PLP parameters are used to make various settings for the possible PLPs. When streaming via TS (TS Stream setting), the PLP parameters can be configured for exactly one PLP. If, however, T2MI is active (T2MI = On), several PLPs from the T2MI

Name	Description	Value range	Access right
Test Signal (Nonlinear Extension)	Generates signals with different modulation in order to increase the video S/N ratio using an external measuring instrument. Measurement of the video S/N ratio and adjustment of the associated slopes allows the S/N ratio to be optimized for various picture contents.	Black, Grey, White, Off	Maintenance
Black Slope (Nonlinear Extension)	Used to optimize the video S/N ratio at high levels. **The value can only be changed if the nonlinear precorrector is in "Stop" mode and the test signal "Black" has been activated.**	-50% to 50%	Maintenance
Grey Slope (Nonlinear Extension)	Used to optimize the video S/N ratio at medium levels. **The value can only be changed if the nonlinear precorrector is in "Stop" mode and the test signal "Grey" has been activated.**	-50% to 50%	Maintenance
White Slope (Nonlinear Extension)	Used to optimize the video S/N ratio at low levels. **The value can only be changed if the nonlinear precorrector is in "Stop" mode and the test signal "White" has been activated.**	-50% to 50%	Maintenance
Phase Correction (FM Carrier 1/2)	Indicates whether the sound phase shifter for carrier 1 and carrier 2 is switched on. The setting can be changed here.	Off, On	Maintenance
Trigger Point 1/2 (FM Carrier 1/2)	Indicates the position defined for the respective onset point of the phase shifter (referenced to modulation of the picture signal). The setting can be changed here.	0% to 100%	Maintenance
Slope 1/2 (FM Carrier 1/2)	Indicates the value that has been set for the slope at the respective onset point of the phase shifter. The setting can be changed here.	-50% to 50%	Maintenance

4.6 Exciter ATSC

4.6.1 Coder for ATSC

To operate the transmitter in ATSC mode, an appropriate software option must be activated using an option key.

The ATSC TV standard can be used both in single frequency networks (SFN) and in multiple frequency networks (MFN). In an SFN, the time at which an ATSC symbol is transmitted is set automatically via the transmission control protocol (TCP). The network mode is selected in the SFN menu. Whether a TCP is present in the data stream is indicated in the two Input menus.

In the Configuration menu, it is possible to activate transmission to mobile terminal equipment and also to set the transmitter IDs for operation in a network.

"Configuration" parameters

- **Path:** *Device View (Home) > Transmitter > Exciter > ATSC Coder > Configuration*

To operate the transmitter in Mobile DTV (MDTV) mode, an appropriate software option must be activated using an option key.

Name	Description	Value range	Access right
Mobile DTV (Configuration)	Indicates whether the coding for Mobile DTV is switched on or off.	Off, On	Maintenance
MHE PID (Configuration)	Indicates which MHE PID is set. The setting can be changed here. The packet ID that is set is the one containing the Mobile DTV data stream. The MHE PID is only available if Mobile DTV has been set to "On".	0 to 8191	Maintenance
Frame Status (Configuration)	Indicates whether the ATSC coder is synchronized using the TCP frames contained in the data stream. A fault can occur if the fed transport stream does not contain a TCP. In this case, the status display of the active input would signal a corresponding TCP fault.	Locked, Unlocked	Read only
Mobile Content (Configuration)	Indicates whether mobile data is contained in the input data stream. This display is only available if Mobile DTV has been set to "On".	Found, Not found	Read only
RF Watermark (Localization)	Indicates the set RF watermark level. The setting can be changed here. It is the level of the RF watermark signal relative to the useful signal. If "Off" is set, no RF watermark signal is generated. The RF watermark allows a distinction to be made between the RF signals of individual transmitters in single-frequency networks for measuring purposes. To enable this, the transmitter ID, for example, is transmitted cyclically in the watermark.	−21 dB to −39 dB in steps of 3 dB, Off	Maintenance
Network ID (Localization)	Indicates the set network ID. The setting can be changed here. Using the network ID, several transmitters in a single-frequency network can be combined to form a group. All the transmitters in a group must be assigned different Tx addresses.	0 to 495	Maintenance
Tx Address (Localization)	Indicates the set transmitter address. The setting can be changed here. The transmitter address allows a distinction to be made between the individual transmitters in a single-frequency network.	0 to 31	Maintenance

"Test" parameters

Name	Description	Value range	Access right
Generate Test Signal	Indicates which test signal is to be generated. ● Off Switches off test signal generation. ● PRBS Generates a PRBS sequence instead of the payload. ● Single Carrier Generates an unmodulated single carrier. The frequency of the single carrier is at the center of the band and therefore deviates from the vision carrier frequency. This test signal can be used to measure the phase noise of the synthesizer. The phase noise must be measured via the RF Monitor Out connector (X61). The cable connected to RF Out (X60) must be removed. In order to protect the amplifiers, this test signal is only generated if the output of the exciter is open. The setting can be changed here.	Off, PRBS, Single Carrier	Maintenance
Testmode	Indicates whether one of the test signals is activated. If a test signal is activated, decoding of the transmitted signal by the transmitter will not be possible.	Off, On	Read only

4.6.2 Setting Transmit Frequency and Output Power

The transmit frequency is configured separately for each R&S TCE900 exciter with an accuracy of ±1 Hz. For the **DVB-T** and **DVB-T2** transmission standards, the channel center frequency must be set during this process.

The output power of the R&S TCE900 exciters is regulated internally to +13 dBm for DTV. It can be attenuated via an integrated attenuator by up to 9 dB (in steps of 3 dB).

Depending on the number of amplifiers that a transmitter has, the attenuator in the R&S TCE900 exciter has to be configured as described below.

The transmit frequency and output power are configured in the following way:

► Navigate to the following using the menu bar:
"Device View (Home)" > "TX<n>" > "Exciter A | B" > "Output" > "Attenuation" (0 dB, 3 dB, 6 dB, 9 dB).

Attenuation setting for R&S THU9

- Transmitter with 1 amplifier: 9 dB
- Transmitter with 2 or more amplifiers: 0 dB

Attenuation setting for R&S TMU9/R&S TMV9

- Transmitter with 1 amplifier: 9 dB
- Transmitter with 2 or more amplifiers: 0 dB

4.6.3 Signal Feed

The TCE900 Exciter has a number of physical inputs depending on the modules and software options installed. Up to two of these inputs can be used parallel to each other for signal feed. They are referred to below as logical inputs. The assignment of physical inputs to logical inputs takes place in a special task during startup of the system. All available physical inputs can also be configured within this task. In normal operation, the two selected logical inputs are visible in the Device View of the exciter. All settings relevant for the logical inputs can be made directly in the Device View. The two logical inputs are available for automatic input switchover in the event of a fault along the feed path.

4.6.3.1 Configuring Physical Inputs

The physical inputs are configured at startup of the system in the menu "Device View" > "Tx<n>" > "Exciter A | B" > "Task View" > "Configure Inputs".

This function allows you to define two logical inputs from the number of available inputs used for the redundancy of the input signal. For each logical input, you can optionally assign a name for the fed program multiplex. This name is displayed in the transmitter and system overview screens.

TS Feed

Every TCE900 Exciter which is suitable for the transmission of digital TV has two transport stream inputs (connector X20 and X21). The data format (ASI/SMPTE/Auto) can be set separately for both inputs. The gross data rate and the packet length are also displayed.

IP Feed

Depending on the installed software options, up to two independent IP feeds are available in the TCE900 Exciter. During startup, each Ethernet socket (X30, X31) must be assigned an IP address in the menu "Device View" > "Tx<n>" > "Exciter A | B" > "Task View" > "Configure TS LAN". The two Ethernet sockets are linked to two logical IP streams which contain additional configuration parameters. Both IP streams support unicast and multicast streams. For multicast streams, the IP address of the multiplexer which makes the stream available in the network must also be specified. It is possible to assign both logical IP streams to the same physical socket, but to specify different multicast addresses. This provides maximum flexibility with regard to different redundancy scenarios in the feed path.

The IP addresses for the Ethernet sockets are configured in the "Configure TS LAN" task and only become effective after the TCE900 Exciter has been restarted.

Settings for Input 1/2 (Transport Stream and IP Stream)

"Transport Stream (TS 1/2)" parameters

Name	Description	Value range	Access right
Stream Status	Indicates whether a valid serial data stream is being fed to the transmitter via the TS1/2 IN sockets (X20/X21). If a fault is displayed here, first check the setting of the TS type (ASI/SMPTE).	OK, No Stream	Read Only
Packet Length	Indicates the detected packet length of the transport stream.		Read Only
MIP (SIP, IIP)	Indicates whether the control information required for SFN mode is contained in the data stream. The displayed name depends on the modulation standard. An error can also be displayed in MFN mode if the coder settings are to be automatically controlled via the transport stream.	OK, No, Fail	Read Only
Gross data rate	Shows the total data rate at the TS feed including stuffing bytes.	1200000 bps	Read Only
Payload data rate	Indicates the information data rate without stuffing bytes on the TS feed. This value is only available if MFN is set (multiple-frequency network), i.e. SFN mode (single-frequency network) must be set to OFF.		Read Only
Data rate	Indicates whether the data rate of the payload matches the selected coder settings.	OK, Too Low, Too High, No Signal	Read Only
Multiplex Name	Here, you can assign any desired name for the multiplex contained in this transport stream. This name is displayed in the transmitter overview and, in the case of n+1 systems, in the automatic transmitter switchover function.	<20 characters>	Read / Write

"IP Stream (IP 1/2)" parameters

Name	Description	Value range	Access right
Stream Status (Status)	Indicates whether a valid data stream is being fed to the transmitter via the IP feed. If a fault is indicated, check the settings of the IP stream and the Ethernet interface.	OK, No Stream	Read Only
Packet Length (Status)	Indicates the detected packet length of the IP stream.		Read Only
Gross data rate (Status)	Indicates the total data rate (gross data rate) on the IP feed.	1200000 bps	Read Only
Payload data rate (Status)	Indicates the information data rate of the multiplex contained in the IP stream.		Read Only
Data rate	Indicates whether the data rate of the payload matches the selected coder settings.	OK, Too Low, Too High, No Signal	Read Only

Name	Description	Value range	Access right
MIP (SIP, IIP)	Indicates whether the control information required for SFN mode is contained in the data stream. The displayed name depends on the modulation standard. An error can also be displayed in MFN mode if the coder settings are to be automatically controlled via the transport stream.	OK, No, Fail	Read Only
RJ45 Connector (Settings)	Used to define the physical network interface to which the logical IP stream is bound. Normally, the TS LAN 1 socket (X30) is coupled to IP stream 1 and the TS LAN 2 socket (X31) to IP stream 2. This allows you to use multiple redundant servers that can be selected automatically using the automatic input signal switchover. However, it is also possible to feed several multicast streams via the same physical Ethernet socket. In this case, too, the automatic input signal switchover function can toggle automatically between two data streams.	TS LAN1, TS LAN2	Maintenance
Protocol (Settings)	Used to select the used network protocol. ● UDP (User Datagram Protocol) for easy, connectionless communication. ● RTP (Realtime Transport Protocol) for packet-oriented communication.	Auto, UDP, RTP	Maintenance
Streaming Mode (Settings)	Used to set the used type of network streaming. ● Unicast: The multiplexer sends the suitable IP stream to the IP address of the TV transmitter. ● Multicast: The TV transmitter subscribes to a multicast IP stream that can be provided by the multiplexer in the feed network to several transmitters at the same time.	Multicast, Unicast	Maintenance
Port (Settings)	Used to set the port number under which the transport stream is expected.	0 to 65535	Maintenance
IP Address (Settings)	Displays the IP address of the generator in Multicast mode. In Unicast mode, the IP address of the selected RJ45 socket of the TCE900 is displayed here. In Multicast mode you can change the IP address here.		Maintenance (Read Only)
Multiplex Name (Settings)	Here, you can assign any desired name for the multiplex contained in this transport stream. This name is displayed in the transmitter overview and, in the case of n+1 systems, in the automatic transmitter switchover function.	<20 characters>	Read / Write

"Settings" parameters

Name	Description	Value range	Access right
Mute on Input Fail (Input Control of Input 1 / Input 2)	Used to determine whether the output signal of the exciter is to be shut down if the input signal of all available inputs fails, or whether "null packets" are to be sent. This switch is available in multiple-frequency networks (MFN) only. In single-frequency networks (SFN), the exciter will always mute if no decodable input signal is fed.	No, Yes	Read / Write
Input Fail Delay (Input Control of Input 1 / Input 2)	Used to set the length of the checkout time which must expire after detection of an input signal fault before the exciter displays a fault. If a short checkout time is set, the system can quickly switch over to a standby exciter if all input signals of the exciter fail. If a long checkout time is set, there will be enough time in the event of a fault to switch to an alternative feed path so that the exciter is prevented from switching over to a redundancy component.	0 s to 600 s	Read / Write
Force Exciter Changeover (On loss Of Input Signal)	Used to determine whether switchover to another redundant exciter is to take place if the input signal fails. This function is available for all redundancy systems (dual drive, backup exciter and n+1). In the "Yes" position, an exciter fault is signaled to the higher-level redundancy control unit, which decides whether to switch over to another exciter or transmitter. In the "No" position, no switchover takes place.	No (Create Warning), Yes (Create Fault)	Read / Write

"Task View Config" parameters

"Device View" > "Tx<n>" > "Exciter A | B" > "Task View" > "Configure Inputs" > "Config"

Name	Description	Value range	Access right
Logical Input 1/2	Used to configure the input interfaces used for two inputs, independently of each other. To test the "seamless switching" function, it is possible to select the same input interface for both inputs. The selection options for the data sources are determined by the installed input interfaces and option keys.	Variable	Maintenance
Multiplex 1/2 Name	Here, you can assign any desired name for the multiplex contained in this transport stream. This name is displayed in the transmitter overview and, in the case of N+1 systems, in the automatic transmitter switchover function.		Maintenance
Monitor Out	For measuring purposes, any input signal can be switched to the TS Monitor-Out socket (X22). The selection options for the data sources are determined by the installed input interfaces and option keys.		Maintenance
IP MUX 1/2	Indicates whether a valid data stream is being fed to the transmitter via the IP feed. If a fault is indicated, check the settings of the IP stream and the Ethernet interface.	Stream OK, No Stream	Query

"Task View TS Feed" parameters

"Device View" > "Tx<n>" > "Exciter A | B" > "Task View" > "Configure Inputs" > "TS Feed"

or: "Device View" > "Tx<n>" > "Exciter A | B" > "Input 1 | 2" > "Transport Stream"

Name	Description	Value range	Access rights
TS 1/2 Type	Used to set the data format for the data streams at X20 and X21. ● Auto: The data format is detected automatically ● ASI: Manual setting for an ASI transport stream ● SMPTE: Manual setting for an SMPTE transport stream	Auto, ASI, SMPTE	Maintenance
Gross data rate	Indicates the total data rate on the IP feed.		Read Only
Stream Status	Indicates whether a valid serial data stream is being fed to the transmitter via the TS1/2 IN sockets (X20/X21). If a fault is displayed here, first check the setting of the TS type (ASI/SMPTE).	OK, No Stream	Read Only
Packet Length	Indicates the detected packet length of the transport stream.		Read Only
MIP/IIP/TCP+DB	Depending on the selected TV standard, this indicates whether additional information for operation in single-frequency networks (SFN) is present in the data stream.		Read Only

"Settings" parameters

"Device View" > "Tx<n>" > "Exciter A | B" > "Input 1 | 2" > "Settings"

Name	Description	Value range	Access right
Mute (on Input Fail)	Used to define the operating behavior when the active input fails. This parameter is available in MFN mode only. ● No – In this mode, the output signal is not suppressed if the active input fails. Null packets are output instead. ● Yes – If the active input fails, the output signal is suppressed.	No, Yes	Maintenance
Input Fail Delay	Used to set a delay time which must elapse following an input signal failure before the output signal is suppressed and a sum fault is generated.	0 s to 600 s	Maintenance
Force Exciter Changeover	Used to determine whether switchover to another redundant exciter is to take place if the input signal fails. This function is available for all redundancy systems (dual drive, backup exciter and N+1). ● Yes – In the "Yes" position, an exciter fault is signaled to the higher-level redundancy control unit which decides whether to switch over to another exciter or transmitter. ● No – In the "No" position, no switchover takes place.	Yes, No	Maintenance

4.6.3.2 Input Signal Switchover

The R&S®TCE900 in the R&S®TCE900 Exciter configuration has an automatic switchover function which, in the event of a signal failure at one logical input, switches over to the other logical input (provided that a valid input signal is available at the other logical input). Before a failure occurs, the preselected input is active. The way in which this automatic switchover function operates is determined by the following factors:

Automatic input switchover ON/OFF

If automatic switchover is OFF, the preselected input remains active even if the input signal fails. If automatic switchover is ON and there is a failure at the (preselected) input, switchover to the standby input takes place.

Input priority (Preferred Input = Logical Input 1/2)

Following switchover of the priority logical input to the standby input, the automatic system switches back to this priority input as soon as a signal returns. All switchover operations are delayed for the set delay times. If the signal fails at both the operating input and the standby input, the priority input always remains active.

Inputs with equal priority (Preferred Input = none)

Following switchover of the active logical input, the second input with the same priority remains active until the input signal fails on this input also. The automatic system switches back to the preselected input, but only if a signal is present on it once again (and if "Switch to" is set to "reserve & back"). All switchover operations are delayed for the set delay times.

Selecting this operating mode minimizes the number of switchover operations and, in certain cases, the number of breaks in transmission.

Direction of switchover (Switch to)

The "reserve and back" switch position enables switchover in both directions, i.e. to and from the standby input, depending on which of the two logical inputs is currently faulty.

The "reserve" switch position ensures that switchover takes place once only. Following switchover, the automatic system switches to "switched" and the "Active" indicator disappears.

Switchback to the preselected input takes place when the active input is switched over by pressing the input selector switch (Selector) and then selecting the preselected input.

If the switch is set to "reserve", the switchback to the preselected input is suppressed.

Seamless switching

The automatic input signal switchover function has an operating mode which permits seamless switching between two inputs. Seamless switching is activated using the "Seamless" switch. If seamless switching is possible, the switchover always takes place immediately, irrespective of the set guard times. Seamless switching is available without restriction for operation in single-frequency networks (SFN). For operation in MFNs, it is necessary to set the maximum expected delay time between the two signal feeds. The signal which arrives earlier is delayed by the set time and the signal which arrives later is adjusted to the earlier signal. The currently measured delay between the two inputs is displayed to provide an adjustment aid. In SFN and MFN mode, signals can be fed via two different media (e.g. ASI and IP).

Manual switchover between inputs

Manual switchover is possible when the automatic input signal switchover function is both on and off.

- Switchover with automatic input signal switchover OFF
  The input can be switched over in the "Home" > "Transmitter" > "Exciter" menu by pressing the input selector switch ("Selector") and then selecting the desired input "Selected Input".
- Switchover with automatic input signal switchover ON
  The input can be switched over in the "Home" > "Transmitter" > "Exciter" menu by pressing the input selector switch ("Selector") and then selecting the desired input "Selected Input" if the two inputs are configured with equal priority (Preferred Input = None).
  If one of the inputs is configured as having priority, switchover is performed by changing the priority input "Preferred Input" in the same menu.

"Automatic input signal switchover" parameters

Name	Description	Value range	Access right
Automatic (State)	Indicates the state of the automatic input signal switchover function. ● Off: The automatic switchover function is switched off. ● Active: The automatic switchover function is ready to switch the currently active input over to the input currently not in use as soon as the input signal of the currently active input fails. ● Changed: The automatic switchover function has switched over from the preferred input to the standby input. "Changed" is only displayed if switchback is not permitted. ("Switch to" = reserve)	Off, Active, Changed	Read Only
Seamless Switch-ing	Indicates whether seamless switching of the input signal is possible. "Not Possible" appears if only one input signal is fed, if two different data streams are present at the two inputs or if in MFN mode the set "Max Delay between Inputs" is not sufficient to align the two signals with each other. If seamless switching is possible, it always takes place immediately when required, regardless of whether a "Guard Time to Reserve" or "Guard Time Back" has been set.	not Possible, Possible	Read Only
Automatic	Activates automatic switchover of the input signal to the standby input if the preferred input fails.	Off, On	Operation

Name	Description	Value range	Access right
Preferred Input	Used to select the preferred input which the automatic input signal switchover function should use whenever possible.	Input 1, Input 2, None	Operation
Selected Input	Used to select the active input to be used when the automatic input signal switchover function is off. If the automatic switchover function is on, the input can be switched over using this switch if Preferred Input is set to "No Preference" or a switchover to the standby input has taken place. Switchover of the input is otherwise performed using the "Preferred Input" switch.	Input 1, Input 2	Operation
Switch to	Used to set the operational response of the automatic switchover function. ● "To Reserve Only": The automatic switchover function switches over once from the preferred input to the standby input and then assumes the "not ready" state. Switching the active input over manually to the preferred input reactivates the automatic switchover function. ● "To Reserve and Back": Following successful switchover to the standby input, the automatic switchover function can also switch back automatically if the signal at the standby input fails.	Reserve Only, Reserve & Back	Maintenance
Guard Time to Reserve	Used to set a guard time which must elapse before the automatic switchover function switches over to the standby input if the input signal at the preferred input fails. The set guard time has no effect if seamless switching is possible. In this case, the switchover always takes place immediately without interruption (i.e. seamlessly).		Maintenance
Guard Time Back	Used to set a guard time which must elapse before the automatic switchover function switches back to the preferred input if the input signal at the standby input fails. If seamless switching is possible, switchover always takes place immediately without interruption regardless of the set guard time. If "to Reserve Only" was selected as the "Direction", the set guard time has no effect.		Maintenance
If Reserve Fails	Used to determine whether the signal at the standby input is to be monitored. ● If the transmitter is operated with only one input signal or the standby input is connected only temporarily, "Do Not Show Warning" must be selected. ● If two redundant input signals are normally supplied to the transmitter, "Show Warning" must be selected.	Do Not Show Warning, Show Warning	Maintenance

4.6.4 Controlling Time of Transmission in Single-Frequency Networks (SFN)

For operation in single-frequency networks (SFN), the R&S®TCE900 exciter has a function which allows the time at which the signal is transmitted to be controlled. In the SFN, time synchronization of all exciters in the network is performed using a seconds pulse (PPS), which is generally obtained at the exciter site via GPS satellites.

Controlling time of transmission

Control of the time of transmission is switched on and off in the "Device View (Home)" > "Transmitter" > "Exciter" > "SFN Regulation" menu ("Time Synchronization" tab) by means of the "SFN Sync" switch (On (SFN) / Off (MFN)). This function can only be used if the exciter has a time reference.

To operate the transmitter with an integrated GPS receiver, an appropriate software option must be activated using an option code.

The following options are available:

- Feed of an external PPS signal (pulse per second)
- Use of an integrated GPS receiver (requires option key)

If the time reference fails during operation, the exciter can revert to its integrated frequency control function (see the chapter "Frequency Control") and calculate a highly precise PPS internally.To do so, the exciter only needs to be able to synchronize with a PPS once for a few seconds after it has started.

If the time and frequency reference fail at the same time, *Holdover Mode* becomes active. In this operating mode, the accuracy of "time of transmission" control depends on the frequency stability of the integrated, temperature-stabilized 10 MHz crystal oscillator (OXCO).

Since, in *Holdover Mode*, calculation of the time of transmission becomes increasingly inaccurate over time, the output signal of the exciter can be switched off after a configurable Guard Time.

Special features

With ATSC, up to three different synchronization types are supported.

An appropriate software option must be activated using an option code for the respective synchronization type.

- R&S Mobile
  If mobile content is transmitted and a Rohde & Schwarz AEM100 Emission Mux/SFN inserter is used, the "RSMobile" synchronization type must be selected.
- R&S A53
  If normal content is transmitted and a Rohde & Schwarz AEM100 Emission Mux/SFN inserter is used, the "RSA53" synchronization type must be selected.
- A/110
  In the case of the standard-conforming SFN synchronization corresponding to ATSC A/110B, the "A/110" synchronization type must be selected. It contains a compatible expansion to allow use of Mobile DTV.

With the synchronization types "R&S Mobile" and "A/110", a distinction is also made as to whether the time of transmission is to be synchronized primarily using data from the TCP information or using data from the dummy bytes.

Setting and display of time of transmission

In the "Device View (Home)" > "Transmitter" > "Exciter" > "SFN Regulation" menu ("SFN Delay" tab), the time of transmission is displayed relative to the reference time.

The time of transmission can be adapted individually by setting an additional static delay.

The following delays occur:

- Maximum Delay
  Time taken for the signal to travel from the playout center (MIP inserter) to the transmit antenna for regular transmission. This delay is set in the SFN adapter and is the default for all transmitters of the SFN.
- Network Delay
  Time taken for the signal to travel from the playout center (SFN adapter) to the input of the exciter. With IP feed, the time for forward error correction (FEC) and packet reordering is added to the Network Delay. This delay depends on the used transmission path.
- Processing Delay
  Minimum transit time of the signal through the exciter. This delay depends on the set transmission parameters.
- Dynamic Delay
  Period of time by which signal processing is delayed artificially in order to achieve the desired time of transmission.
- Total Delay
  Actual transit time of the signal through the exciter. This time is the sum of Processing Delay plus Dynamic Delay.
- Static SFN Delay
  Positive or negative offset (set manually for the individual transmitter location) of the time of transmission relative to the regular time of transmission preset under Maximum Delay. The Static SFN Delay is used to compensate for differences between transmission systems from different manufacturers.
- Dispatch Time
  This is the actual time of transmission. It is the network-wide Maximum Delay plus the transmitter-specific Static SFN Delay.

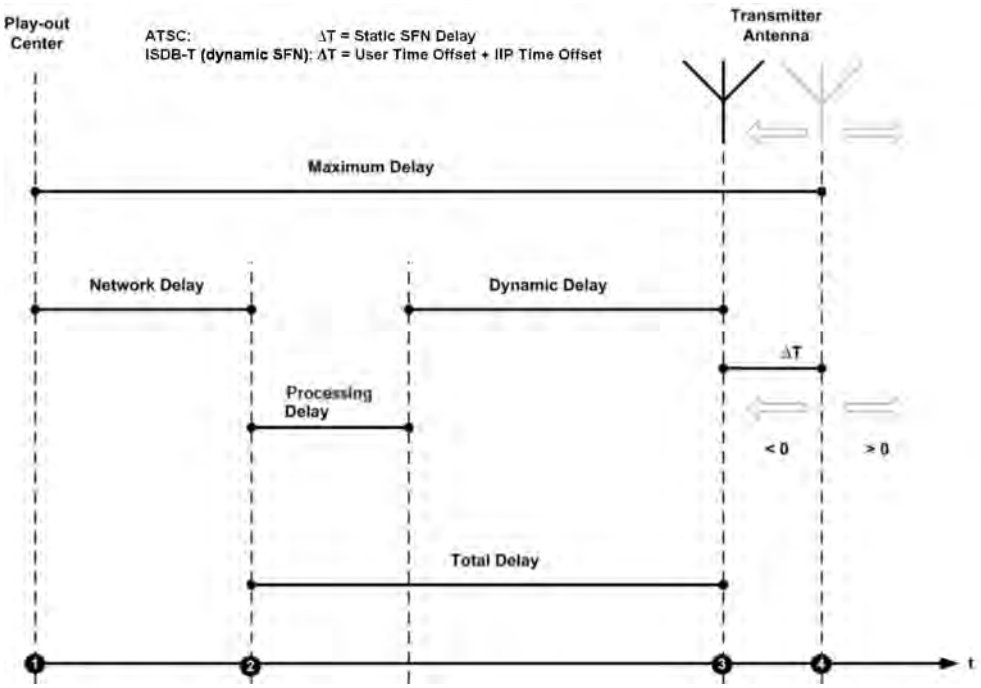


Fig. 4-6: Delays in SFN

1 = Time of the signal infeed (MIP inserter)
2 = Signal feed at the exciter (Ts x IN)
3 = Regular time of transmission for the station (Tx)
4 = Individually corrected time of transmission for the station (Dispatch Time)

4.6.4.1 Settings

"Time Synchronization" parameters

- **Path:** "Device View (Home)" > "Tx<n > " > "Exciter A | B" >"SFN Regulation" > "Time Synchronization"

Name	Description	Value range	Access right
Source	The suitable signal source for synchronizing the time of transmission can be selected in this list.	External PPS, Internal GPS	Maintenance
Ext. PPS	Indicates whether a seconds pulse is present at the 1PPS_IN socket (X23) at the TCE.	No Signal, Inaccurate, OK	Read only
Int. GPS PPS	Indicates whether the integrated GPS receiver is returning a stable seconds pulse (PPS). This function must have been enabled by installing an option key in the TCE.	No Signal, Inaccurate, OK	Read only

Name	Description	Value range	Access right
SFN Sync	Used to activate time synchronization. ● Off (MFN): The time of transmission is not controlled. ● Dynamic (SFN): The time of transmission of a symbol is the same for all the transmitters of a single-frequency network (SFN).	Off (MFN), Dynamic (SFN)	Maintenance
SFN Sync Mode	Used to define the type of time synchronization. This switch is available only after the appropriate software options have been enabled. ● RSMobile: For transmitting mobile content and when using a Rohde & Schwarz AEM100 Emission Mux/SFN inserter. ● RSA53: When transmitting normal content and when using a Rohde & Schwarz AEM100 Emission Mux/SFN inserter. ● A/110: For standard-conforming SFN synchronization corresponding to ATSC A/110B. It contains a compatible expansion to allow use of Mobile DTV. With the synchronization types "R&S Mobile" and "A/110", a distinction can also be made as to whether the time of transmission is to be synchronized primarily using data from the TCP information or using data from the dummy bytes.	RSMobile, RSA53, A/110	Maintenance
PPS State	Indicates whether the internally formed PPS is phase-synchronized with the frequency control. ● OK: The PPS is phase-synchronized with the frequency control. ● Holdover: The PPS and the reference frequency of the frequency control have failed. Time synchronization is now performed with the accuracy of the integrated crystal oscillator (OCXO). ● Holdover Expired: The maximum time for which the transmitter is permitted to remain in holdover mode has expired (see the Frequency Control menu). ● Missing: No PPS signal has been detected since the TCE900 exciter was last started. If "OK" is not displayed, the signal source of the frequency control must be checked.	OK, Holdover, Holdover expired, Missing	Read only
Max. Deviation	Used to select the maximum permitted deviation of the time of transmission relative to the internally controlled reference frequency. If the set value is exceeded, the absolute time of transmission is recalculated. This causes a brief signal failure (mute).	0 s to 100 µs	Read only
SFN State	Indicates whether or not the fed signal can be transmitted in a time-synchronous manner. If the "No Time Reference" fault message is displayed, the reference feed of the Time Synchronization and the Frequency Regulation must be checked. If the "No Time Information" fault message is displayed, it must be checked whether the control information for the time of transmission is contained in the data stream. (See the "Input" menu.)	SFN Resync, No Time Information, No Time Reference, SFN Resync, In Time	Read only

"SFN Delay" parameters

- **Path:** "Device View (Home)" > "Tx<n > " > "Exciter A | B" >"SFN Regulation" > "SFN Delay"

Name	Description	Value range	Access rights
Maximum Delay	Time taken for the signal to travel from the playout center to the transmit antenna for regular transmission. This delay is set at the SFN adapter and is the default for all transmitters of the dynamic SFN.	0 s to 1 s	Read only
Network Delay	Time taken for the signal to travel from the playout center to the input of the signal processing unit. This delay depends on the used transmission path. If an IP feed is used, the FEC processing time is a component of the Network Delay.	0 s to 1 s	Read only
Processing Delay	Indicates the internal transit time for signal processing in the exciter. It depends on the configured modulation parameters.	0 s to 1 s	Read only
Dynamic Delay	Indicates the signal delay controlled by the SFN (single-frequency network) synchronization which is required in order to meet the desired time of transmission exactly. The displayed value contains the set Static Delay Offset as well as the Tx Time Offset (if available).	0 s to 1 s	Read only
Total Delay	Indicates the total transit time of the signal through the transmitter. It is the sum of Processing Delay plus Dynamic Delay.	0 s to 1 s	Read only
Static SFN Delay	Positive or negative offset (set manually for the individual transmitter site) of the time of transmission relative to the regular time of transmission preset under Maximum Delay. The Static Delay is used to compensate differences between transmission systems from different manufacturers.	0 s to 1 s	Maintenance
Dispatch Time	Time from the point at which the signal leaves the playout center until its actual transmission at the transmit antenna. This delay corresponds to the Maximum Delay (compulsory for all transmitters in an SFN) plus Static Delay Offset plus Tx Time Offset (if available).	0 s to 1 s	Read only

4.6.5 Using Frequency Control

The R&S TCE900 in the R&S TCE900 exciter configuration has a transmit frequency control function.

Depending on the accuracy and stability requirements, one of two operating modes can be selected for the transmitter.

To operate the transmitter with an integrated GPS receiver, an appropriate software option must be activated using an option code.

- **Free-wheeling mode**
  Here the transmit frequency is formed from a temperature-stabilized 10 MHz crystal oscillator (TCXO).
  The frequency stability is sufficient for continuous operation in multiple frequency networks (MFN).

- **Operation with reference frequency**
  Here the transit frequency is stabilized by means of a reference frequency. The following options are available:
  – External 10 MHz reference frequency
  – External PPS (pulse per second)
  – Built-in GPS receiver.

  The frequency stability and frequency accuracy which can be achieved in this way fulfill the increased requirements for operation of the transmitter in single-frequency networks. If several reference signals are available at the same time, automatic selection of the most suitable reference frequency is possible.

If the reference signal fails, the transmitter switches over to *Holdover Mode* and frequency control operates with the accuracy of the temperature-stabilized 10 MHz crystal oscillator (OXCO).

Since, in *Holdover Mode*, frequency control becomes increasingly inaccurate over time, the output signal of the exciter can be switched off after a configurable Guard Time.

In the case of reference signals with major fluctuations (jitter), e.g. with non-controlled external GPS receivers, a jitter correction function can be activated.

For measuring purposes, the used reference signal or one of the reference signals processed internally in the exciter can be output via the Monitor-Out socket (X24).

"Frequency Regulation" parameters

- **Path:**"Device View (Home)" > "Tx<n>" > "Exciter" > "Frequency Regulation" > Tab "Frequency Regulation"

Name	Description	Value range	Access right
Ext. 10 MHz (Input)	Indicates whether an external 10 MHz reference is present at the REF_IN (X64) socket on the R&S TCE900.	No Signal, Inaccurate, OK	Read only
Source (Input)	The suitable signal source for the frequency reference can be either detected automatically or preselected in this list. If multiple signal sources are connected simultaneously in "Auto" position, an external reference is given preference for selection before the internal GPS. In "Manual" position, the internal crystal oscillator (OCXO) is calibrated manually and the transmitter can be operated completely without an external reference source (not suitable for single-frequency networks).	Manual, Ext. 5 MHz, Ext. 10 MHz, Ext. PPS, Int. PPS GPS, Auto	Read only
Ext PPS (Input)	Indicates whether a seconds pulse is present at the 1PPS_IN socket (X23) at the R&S TCE900.	No Signal, Inaccurate, OK	Read only
Current Source (input)	Shows the signal source used currently for frequency regulation.	Manual, Ext. 5 MHz, Ext. 10 MHz, Ext. PPS, Int. GPS	Read only

Name	Description	Value range	Access right
Int. GPS PPS (Input)	Indicates whether the integrated GPS receiver is returning a stable seconds pulse (PPS). This function must have been enabled by installing an option key in the TCE.	No Signal, Inaccurate, OK	Read only
Manual OCXO (regulator)	Enables manual adjustment of the internal crystal oscillator. To allow this, a frequency counter which is synchronized via a highly accurate reference must be connected via the monitor output.	0 to 65535	Maintenance
Reference (regulator)	Indicates the state of the reference used. In single-frequency networks, a failure of the reference can cause a malfunction and thus lead to switchover of the exciter.	Fault, Warning, OK	Read only
Freq. Stability (regulator)	Indicates the frequency accuracy of the regulator. The highest possible accuracy ("Excellent") is only reached at least 24 hours after switching on the exciter. This ensures that if the reference fails, there are no faults in single-frequency networks before the guard time runs out.	Unknown, Inaccurate, Good, Excellent	Read only
Monitor Out (regulator)	Used to select the signal to be output at the Monitor Out socket (X24).	Off, Internal 5 MHz, Internal 10 MHz, Internal 1 PPS, Internal 1 PPS GPS, Current Source	Operation
On Ref. Fail Mute (regulator)	Used to define the behavior if the reference source fails. ● "Never": Muting never takes place. This causes faults in single-frequency networks, especially after power failures. ● "At Startup": After a power failure, muting takes place until the regulator is synchronized. If the reference fails, the transmitter will continue running as long as possible. ● "After Guard Time": Muting takes place not only after power failures, but also after failure of the reference and expiry of the set Guard Time.	Never, At Startup, After Guard Time	Maintenance
Guard Time (regulator)	This value defines for how many hours the signal processing should continue running without synchronization if the reference connection fails. The Guard Time is active only if the "Freq Stability" was "Good" at the time of the failure. The longer the time selected is, the poorer the accuracy of the transmitting frequency will become. In addition, the time of transmission of the signal shifts. If this uses up the guard interval, reception problems occur in single-frequency networks.	0 to 24 hours	Maintenance
Jitter Correction (Guard Time)	When using an external reference source with high jitter, activating this function can provide better frequency stability. With "Good" reference signals, this function should be disabled as the regulator takes significantly longer to attain its maximum frequency stability. When the internal GPS is used, this function is enabled automatically.	On, Off	Maintenance

4.6.6 Precorrection

Each R&S®TCE900 Exciter is equipped with an adaptive precorrector, which continuously compensates for nonlinear distortions of the amplifiers and linear distortions of the output filter so that, in both cases, a high-quality signal is present at the output of the transmitter.

Adaptive nonlinear precorrection

For adaptive nonlinear precorrection, enter a minimum shoulder distance that must not be undershot. The precorrector will calculate a new precorrection curve as soon as a shoulder distance below the set value is measured.

The adaptive precorrection can be stopped if necessary (Adaptive Predistortion = Stop). The current precorrection curve remains in effect.

For measuring purposes, the adaptive nonlinear precorrector can be bypassed (Adaptive Predistortion = Bypass) so that the R&S®TCE900 Exciter returns an undistorted signal at its RF output.

The precorrector can be restarted manually (Reset), making it possible to calculate a better precorrection curve, even if the shoulder distance has not yet been undershot. The current precorrection curve is lost as a result.

Adaptive linear precorrection

With adaptive linear precorrection, limit values for amplitude (Amplitude Ripple) and group delay (Group Delay Ripple) must be set. The precorrector will calculate a new precorrection curve as soon as the limit values are exceeded.

The adaptive precorrection can be stopped if necessary (Adaptive Predistortion = Stop). The current precorrection curve remains in effect.

For measuring purposes, the adaptive linear precorrector can be bypassed (Adaptive Predistortion = Bypass) so that the R&S®TCE900 Exciter returns an undistorted signal at its RF output.

The precorrector can be restarted manually (Reset), making it possible to calculate a better precorrection curve, even if the shoulder distance has not yet been undershot. The current precorrection curve is lost as a result.

The adaptive adjustment of nonlinear precorrection is not available for analog TV standards.

Crest factor reduction

Available as an option for all COFDM standards

The crest factor feature provides the possibility of improving the signal parameters "MER" and "Shoulder Distance" separately. Additionally, the signal can be improved and the DC supply voltage reduced at the amplifier to increase efficiency; this simultaneously reduces the crest factor of the transmitter.

Sound phase shifter

Only available for analog TV standards

The sound phase shifter modifies the phase of the sound subcarrier as a function of the low-frequency modulation of the picture signal.

When the sound phase shifter is switched on, its characteristic is determined using two onset points.

The reference for setting the position is initially a value of 37.5 % for the back porch. Smaller values are in the range of the sync pulse, whereby a value of 15 % corresponds to a sync-pulse amplitude of 300 mV. Larger values are in the picture range, whereby a value of 90 % corresponds to a picture amplitude of 700 mV.

An additional condition is that the setting for onset point 1 must always be greater than that of onset point 2. The sharpness of the two onset points is determined by the slope of the characteristic at these points. The magnitude of the setting determines the magnitude of the phase shift, whereby a setting of 50 % specifies the maximum value. The sign of the setting value determines whether the phase is shifted in the positive or negative direction.

When the characteristic is calculated, it is divided into three linear areas by the two onset points.

No phase shift takes place for modulation of the picture signal in the area between the two onset points, i.e. a correction phase of 0° is set.

A correction phase unequal to 0° is set in the case of picture signal modulation which is greater than the position of onset point 1. The characteristic in this area begins with a correction phase of 0°, with modulation corresponding to the position of onset point 1, and increases linearly up to the maximum phase set with slope 1, with 100 % modulation of the picture signal.

Similarly, a correction phase unequal to 0° is also set in the case of picture signal modulation which is smaller than the position of onset point 2. The characteristic in this area begins with a correction phase of 0°, with modulation corresponding to the position of onset point 2, and increases linearly up to the maximum phase set with slope 2, with 0 % modulation of the picture signal.

"Non Linear" parameters

- **Path:***Device View (Home) > Transmitter > Exciter > Pre-Correction > Non Linear*

Name	Description	Value range	Access right
Adaptive Precorrection (Settings)	The nonlinear precorrector is used to compensate amplifier faults. The quality of precorrection affects the shoulder distance of the output signal. The setting can be changed here. ● Bypass The nonlinear precorrector is deactivated. The signal is not modified inside the exciter. ● Stop Adaptive precorrection is deactivated. The correction curve that was determined last is active inside the exciter. ● Run **Digital TV standards only:** The adaptive precorrector is active. The best possible precorrection curve to compensate amplitude and phase errors of the amplifiers is determined continuously. **Analog TV standards only:** The automatic precorrector is active. The best possible precorrection curve to compensate amplitude and phase errors of the amplifiers is determined once. The precorrector then enters "Stop" mode. The program is interrupted during precorrection. In certain situations, it may be advisable to have a suitable precorrection curve determined automatically first and then to switch adaptive precorrection to "Stop" so that the found precorrection curve can no longer change. Calculation of a new precorrection curve can be forced by performing a reset.	Bypass, Stop, Run	Maintenance
Status (Settings)	Indicates the status of the nonlinear precorrector. ● Idle The precorrector is not active. ● Acquisition The precorrector is currently recording new measurement values. ● Calculation The precorrector is currently calculating a new precorrection curve.	Idle, Acquisition, Calculation	Read Only
Input Level (Settings)	Indicates whether the level of the input signal is sufficient. "No Input" appears if the transmitter is off or if the connection to the RF test point is interrupted.	OK, Too Low, Too High, No Input	Read Only
Reset (Settings)	Resets the precorrection. If the precorrector is in "run" mode, a new precorrection curve is calculated.		Maintenance
Shoulder Distance (Shoulders)	Indicates the minimum shoulder distance that is to be achieved by the adaptive nonlinear precorrector. The setting can be changed here. The precorrector will calculate a new precorrection curve as soon as a shoulder distance below the set value is measured.	30 dB to 45 dB	Maintenance
Shoulder Left (Shoulders)	Indicates the shoulder distance attained by the circuit for automatic switchover, measured in the left part of the signal spectrum.		Read Only
Shoulder Right (Shoulders)	Indicates the shoulder distance attained by the circuit for automatic switchover, measured in the right part of the signal spectrum.		Read Only
Signal Limiter (Limiter)	Limits the signal at the input of the nonlinear precorrector. The setting can be changed here.	6 dB to 12 dB	Maintenance

"Linear" parameters

- **Path:***Device View (Home) > Transmitter > Exciter > Pre-Correction > Linear*

Name	Description	Value range	Access right
Adaptive Precorrection (Settings)	The linear precorrector is used to compensate output filter faults. The quality of precorrection affects the amplitude and group delay ripple of the output signal. The setting can be changed here. ● Bypass The linear precorrector is deactivated. The signal is not modified inside the exciter. ● Stop Adaptive precorrection is deactivated. The correction curve that was determined last is active inside the exciter. ● Run **Digital TV standards only:** The adaptive precorrector is active. The best possible precorrection curve to compensate for amplitude and group delay errors caused by the output filter is determined continuously. **Analog TV standards only:** The automatic precorrector is active. The best possible precorrection curve to compensate for amplitude and group delay errors caused by the output filter is determined once. The precorrector then enters "Stop" mode. The program is interrupted during precorrection. In certain situations, it may be advisable to have a suitable precorrection curve determined automatically first and then to switch adaptive precorrection to "Stop" so that the found precorrection curve can no longer change.	Bypass, Stop, Run	Maintenance
Status (Settings)	Indicates the status of the linear precorrector. ● Idle The precorrector is not active. ● Acquisition The precorrector is currently recording new measurement values. ● Calculation The precorrector is currently calculating a new precorrection curve.	Idle, Acquisition, Calculation	Read Only
Input Level (Settings)	Indicates whether the level of the input signal is sufficient. "No Input" appears if the transmitter is off.	OK, Too Low, Too High, No Input	Read Only
Slope (Settings)	Indicates the asymmetry compensation caused by the RF cable used between the RF test point downstream of the output filter and the input of the linear precorrector. The setting can be changed here.	-1 dB to 1 dB	Maintenance
Reset (Settings)	Resets the precorrection. If the precorrector is in "run" mode, a new precorrection curve is calculated.		Maintenance
Amplitude Ripple Limit (Amplitude Ripple Limiter)	Indicates the desired maximum amplitude ripple at the output of the filter. If the circuit for automatic switchover is switched on, the precorrector attempts to modify the signal to such an extent that the amplitude ripple remains below the specified limit. The setting can be changed here.	0 dB to 2 dB	Maintenance

Name	Description	Value range	Access right
Amplitude Ripple (Amplitude Ripple Limiter)	Indicates whether the limit set for the amplitude ripple can be achieved by the linearity corrector. If the limit was chosen too low, a warning is displayed. In this case, the corrector will retain the last-calculated curve.	Limit OK, limit unreachable	Read Only
Amplitude Ripple (Amplitude Ripple Limiter)	Indicates the residual ripple in the amplitude frequency response attained by the circuit for automatic switchover in dB.		Read Only
Group Delay Limit (Group Delay Limiter)	Indicates the desired maximum group delay ripple at the output of the filter. If the circuit for automatic switchover is switched on, the precorrector attempts to modify the signal to such an extent that the group delay ripple remains below the specified limit. The setting can be changed here.	10 ns to 500 ns	Maintenance
Group Delay (Group Delay Limiter)	Indicates whether the limit set for the group delay can be achieved by the linearity corrector. If the limit was chosen too low, a warning is displayed. In this case, the corrector will retain the last-calculated curve.	Limit OK, limit unreachable	Read Only
Group Delay Ripple (Group Delay Ripple)	Indicates the residual ripple in the group delay attained by the circuit for automatic switchover in ns.		Read Only

"Crest Factor" parameters

Available as an option for all COFDM standards

- **Path:***Device View (Home) > Transmitter > Exciter > Pre-Correction > Crest Factor*

Name	Description	Value range	Access right
Reduction	Activates manual crest factor reduction. This function is used to optimize the efficiency of the transmitter. • Bypass Deactivates the crest factor reduction. • Manual Activates manual crest factor reduction.	Bypass, Manual	Maintenance
Crest Factor	Used to set the crest factor of the exciter's output signal. Setting a low crest factor allows the efficiency of the transmitter to be increased as a result of the lower operating voltage of the amplifiers. This can lead to an increase in intermodulation products outside the frequency band and to a reduction in MER.	7 dB to 15 dB	Maintenance
Inband Noise	Increasing this value results in a lower crest factor. This, however, reduces MER.	10% to 100%	Maintenance
Outband Noise	Increasing this value produces a lower crest factor; however, this results in an increase in intermodulation products outside the frequency band.	0% to 50%	Maintenance

"Advanced Precorrection" parameters

Available for analog TV standards

- **Path:***Device View (Home) > Transmitter > Exciter > Pre-Correction > Advanced Precorrection*

Name	Description	Value range	Access right
Test Signal (Nonlinear Extension)	Generates signals with different modulation in order to increase the video S/N ratio using an external measuring instrument. Measurement of the video S/N ratio and adjustment of the associated slopes allows the S/N ratio to be optimized for various picture contents.	Black, Grey, White, Off	Maintenance
Black Slope (Nonlinear Extension)	Used to optimize the video S/N ratio at high levels. **The value can only be changed if the nonlinear precorrector is in "Stop" mode and the test signal "Black" has been activated.**	-50% to 50%	Maintenance
Grey Slope (Nonlinear Extension)	Used to optimize the video S/N ratio at medium levels. **The value can only be changed if the nonlinear precorrector is in "Stop" mode and the test signal "Grey" has been activated.**	-50% to 50%	Maintenance
White Slope (Nonlinear Extension)	Used to optimize the video S/N ratio at low levels. **The value can only be changed if the nonlinear precorrector is in "Stop" mode and the test signal "White" has been activated.**	-50% to 50%	Maintenance
Phase Correction (FM Carrier 1/2)	Indicates whether the sound phase shifter for carrier 1 and carrier 2 is switched on. The setting can be changed here.	Off, On	Maintenance
Trigger Point 1/2 (FM Carrier 1/2)	Indicates the position defined for the respective onset point of the phase shifter (referenced to modulation of the picture signal). The setting can be changed here.	0% to 100%	Maintenance
Slope 1/2 (FM Carrier 1/2)	Indicates the value that has been set for the slope at the respective onset point of the phase shifter. The setting can be changed here.	-50% to 50%	Maintenance

4.7 Exciter DTMB

4.7.1 Coder for DTMB

To operate the transmitter in DTMB mode, an appropriate software option must be activated using an option key.

The DTMB transmission parameters required for coding and modulation as well as the TPS settings (TPS = transmission parameter signaling) used and signaled during transmission can be checked in the "Config" and "Modulation" menu fields.

The DTMB standard can be used both in single frequency networks (SFN) and multiple frequency networks (MFN). In SFNs, the TPSs are usually set automatically by the megaframe information packet (MIP) or second frame initialization packet (SIP); in MFNs, the TPS parameters are usually set manually.

Name	Description	Value range	Access right
Guard Time (regulator)	This value defines for how many hours the signal processing should continue running without synchronization if the reference connection fails. The Guard Time is active only if the "Freq Stability" was "Good" at the time of the failure. The longer the time selected is, the poorer the accuracy of the transmitting frequency will become. In addition, the time of transmission of the signal shifts. If this uses up the guard interval, reception problems occur in single-frequency networks.	0 to 24 hours	Maintenance
Jitter Correction (Guard Time)	When using an external reference source with high jitter, activating this function can provide better frequency stability. With "Good" reference signals, this function should be disabled as the regulator takes significantly longer to attain its maximum frequency stability. When the internal GPS is used, this function is enabled automatically.	On, Off	Maintenance

4.11 Switchless Combiner

The switchless combiner couples the RF output signals of two racks and feeds the total power to the antenna. If a rack has a power drop, the switchless combiner ensures maximum output power at the antenna by a continuous shift of the phase angle.

Operating principle

The switchless combiner consists of two 90-degree couplers and an RF tube of variable length (referred to as a trombone). Changing the length makes it possible to generate a variable phase shift between the two inputs. If there is a complete power drop at an input, the power of the other input can be fed to the antenna without loss. If there is a partial power drop at one of the two inputs, the power dissipation in the absorber is minimized by adjusting the phase angle.

Commissioning

During commissioning, the position of the trombone has to be calibrated for different phase angles. To do so, connect an external power meter to the absorber of the switchless combiner.

The calibration process consists of the following work steps:

- Start the calibration process.
- Set the switchless combiner to "local".
- Switch the signal of input 1 off.
- Press the up/down buttons on the switchless combiner to set the trombone so that the power dissipation at the absorber is minimal.
- Press "Save Position".
- Switch the signal of input 1 on and of input 2 off.
- Press the up/down buttons on the switchless combiner to set the trombone so that the power dissipation at the absorber is minimal.

- Press "Save Position" again.
- Switch the signal of input 2 back on.
- End the calibration process and set the switchless combiner to "remote".

Finally, use the phase shifter in rack 2 to set a power maximum at the antenna.

The calibration process has to be carried out again after changing the frequency. In addition, the switchless combiner has to be reprogrammed beforehand according to the manufacturer's instructions.

Operation

In "Automatic" mode, the switchless combiner responds to power losses at its inputs independently. In "Manual" mode, one of three fixed positions of the trombone can be moved to, for example, to switch off a rack.

4.11.1 Settings

"Overview" parameters

- **Path:** "Device View (Home)" > "Tx<n >" > "Output Stage" >"Switchless Combiner" > "Overview"

Name	Description	Value range	Access right
Automatic (Control)	Switches the automatic power control of the rack combiner on and off.	Off, On	Maintenance
Position (Control)	Indicates which input was switched to the antenna when automatic is switched off. The setting can be changed here.	1, 2, 1+2	Read only
Current Position (Regulation)	Indicates the current effective phase angle between the two inputs. If the coupling is symmetric, the phase angle is 90 degrees. If the switchless combiner has not yet been calibrated for the current transmitter frequency, the display shows a %.	0 degrees to 180 degrees, 0 % to 100 %	Read only
Status (Regulation)	Indicates whether the control is currently working: ● Hold: The phase angle is constant. ● Phase decreasing/Phase increasing: The phase angle is currently being changed.	Hold, Phase decreasing, Phase increasing	Read only
Calibration (Regulation)	Indicates whether the switchless combiner has been calibrated for the current transmitter frequency. ● OK: The switchless combiner is calibrated. ● Warning: The switchless combiner has not yet been calibrated.	Ok, Warning	Read only
Access (Device Status)	Indicates whether the switchless combiner is in "Local" mode or "Remote" mode. For the control to work, the switchless combiner has to be in "Remote" mode.	Local/ Remote	Read only

Name	Description	Value range	Access right
Link (Device Status)	Indicates whether there are data communications between the transmitter and switchless combiner.	SFN Resync, No Time Information, No Time Reference, SFN Resync, In Time	Read only
Warning (Device Status)	Indicates whether the switchless combiner signals a warning. This indication is identical to the indication on the control panel of the switchless combiner.	Off, Yes	Read only
Fault (Device Status)	Indicates whether the switchless combiner signals an error. This indication is identical to the indication on the control panel of the switchless combiner.	Off, Yes	Read only
RF Probe (Device Status)	Indicates whether the test point at the antenna output functions.	OK, Fail	Read only
RCB (Device Status)	Indicates whether the redundancy control board in the R&S TCE900 system control functions without errors.	OK, Fail	Read only

"Calibration" parameters

- **Path:** "Device View (Home)" > "Tx<n >" > "Output Stage" >"Switchless Combiner" > "Calibration"

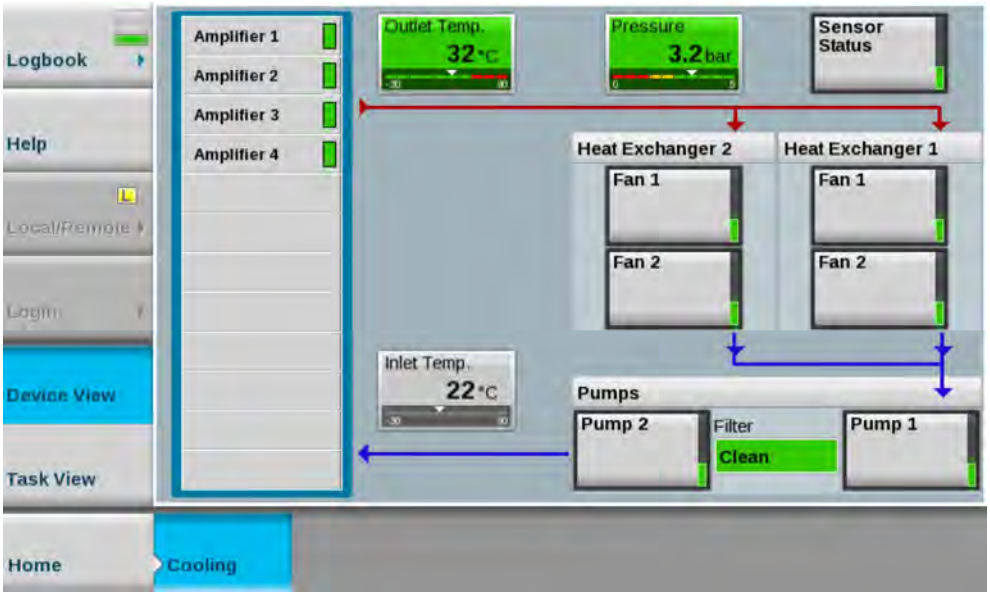
Name	Description	Value range	Access right
Calibration (Calibration)	Starts the calibration process. The calibration steps to be carried out are displayed in the "Instruction" field after the calibration process has been started.	Off, On	Maintenance
Save Position (Calibration)	Saves the upper or lower position of the trombone during the calibration process.		Maintenance
Forward Power (Calibration)	Indicates the power at the antenna.	0 kW to 100 kW	Read only
Transmitter (Calibration)	Indicates whether the transmitter is switched on. The setting can be changed here.	Off, On	Maintenance
Instruction (Calibration)	Indicates the next step after starting the calibration process.		Read only
Rack 1-4 (Calibration)	Indicates whether the respective rack is switched on. During the calibration process, the RF at the inputs of the switchless combiner can be switched off using this switch.	Auto/Off	Maintenance
Access Combiner (Status)	Indicates whether the switchless combiner is in "Local" mode or "Remote" mode. For the control to work, the switchless combiner has to be in "Remote" mode	Local/ Remote	Read only
Status (Status)	Indicates whether the switchless combiner has been calibrated for the current transmitter frequency.	Calibrated, Uncalibrated	Read only

Name	Description	Value range	Access right
Position (degree) (Status)	Indicates the currently set phase angle. This display is available only if the switchless combiner has been calibrated.	0 degrees to 180 degrees	Read only
Position (raw) (Status)	Indicates the position of the trombone (unitless).	0 to 1024	Read only

4.12 Cooling System

4.12.1 Liquid Cooling (High-Performance)

The following illustration shows the "Cooling" menu for liquid cooling.



4.12.1.1 Configuring Switching Thresholds (Pressure) and Flow Volumes

- **Path:***Device View (Home) > Cooling*

Name	Description	Value range	Access right
Type	A distinction must be made between the following types: ● R&S Standard If the transmitter is connected to a 9000 series cooling system, select "R&S Standard". ● If the transmitter is connected to an existing site cooling system, select the "Site Cooling" setting. In this case, warning and fault signaling lines which are routed to terminal x8000 of the mains distribution board (MDB) are evaluated. ● If an FM single transmitter is connected to a simplified cooling system without temperature control, select the "R&S Small" setting.	R&S Standard, Site Cooling, R&S Small	Configuration
Heat Exchangers / Rack	Either 1 or 2 redundant heat exchangers can be used in each rack. The set value affects fan monitoring and also the indicators on the user interface.	1 or 2	Configuration
Fans / Heat Exchanger	Either 1 or 2 fans can be used for each heat exchanger. The set value affects fan monitoring and also the indicators on the user interface.	0, 1 or 2	Configuration
Set Point Temperature	At this temperature, the temperature control system will attempt to adjust the coolant temperature by changing the fan speed at the heat exchangers. If the temperature drops below or exceeds the control range, the actual coolant temperature can be higher or lower.	25 to 65	Configuration
Fault Limit (Coolant Temperature)	If the coolant temperature exceeds this value, a fault is triggered and the rack is shut down. In N+1 systems, this event can lead to switchover of the transmitter.	50 to −65	Configuration
Warning Limit (Coolant Temperature)	If the coolant temperature exceeds this value, a warning is triggered. The fault threshold is permanently set to 65 °C.	40 to 65	Configuration
(Coolant Pressure) Warning Limit	If the coolant pressure drops to this value or lower, a warning is triggered. Normally, this value should be set higher than the value for the corresponding "Fault Limit".	0 to 4	Configuration
(Coolant Pressure) Fault Limit	If the coolant pressure drops to this value or lower, a fault is triggered. Normally, this value should be lower than the value for the corresponding "Warning Limit".	0 to 4	Configuration
Max Fan Speed	If necessary, the maximum speed of the fans at the heat exchanger can be decreased in order to reduce noise. This can, however, result in an increase in coolant temperature or even in shutdown of the transmitter.	50 % to 100 %	Configuration
If Temperature Exceeds Warning Limit (Fans)	If a speed limit has been activated for the fans, this switch can be used to select how the cooling system is to respond if the warning threshold for the return temperature is exceeded. ● "Keep Fans Quiet" The speed limit for the fans remains activated. The transmitter is shut down when the fault threshold for the return temperature is reached. ● "Rise Noise Level of Fans" The set speed limit for the fans is deactivated and the fan speed is automatically increased to max. 100 % of the nominal speed.	Keep Fans Quiet 1 = Rise Noise Level of Fans	Configuration

Name	Description	Value range	Access right
If Temperature Exceeds Warning Limit (RF)	Automatic reduction of the output power can be performed in order to reduce the temperature level of cooling when the warning threshold is exceeded. In this case, the amplifiers are automatically precorrected corresponding to their lower power.	Keep Nominal RF Power Reduce RF Power to 80 % Reduce RF Power to 60 %	Configuration
Extra Flow Rate	In addition to the minimum flow rate predetermined by the number of amplifiers, the flow can be increased in two stages if additional components which require cooling (e.g. dummy load) are installed.	0 +10 +20	Configuration
Hide Pump Errors	During registration of pumps on the pump bus, this switch can be used to hide fault messages which could otherwise cause the transmitter to shut down. This makes it possible to disconnect pumps from the bus without interrupting operation.	Off On	Maintenance
Hide Fan Errors	During registration of fans on the fan bus, this switch can be used to hide fault messages which could otherwise cause the transmitter to shut down. This makes it possible to disconnect fans from the bus without interrupting operation. The switch acts on all fans of an output stage.	Off On	Maintenance
Site Cooling Warning	Warnings from the site cooling system are displayed here. This message only functions if the appropriate signals from the site cooling system are supplied via terminal x8000 of the mains distribution board (MDB).	OK Warning	Read only
Site Cooling Fault	Faults at the site cooling system are displayed here. This message only functions if the appropriate signals from the site cooling system are supplied via terminal x8000 of the mains distribution board (MDB).	OK Fault	Read only
Pump (State)	Indicates whether the pump has been correctly registered on the pump communication bus by the transmitter control unit.	Not Found Installed	Read only
Motor (State)	Indicates whether the pump motor can run freely or is mechanically blocked. To rectify this fault, the pump must be disassembled and checked for foreign objects.	Blocked OK	Read only
Operating Hours (Pump)	Indicates how long the pump has been in operation.	0 to 999999	Read only
(Pump) Type	Indicates the used pump type. The displayed type is identical to the type specified on the type plate of the pump. ● The type "40-100" should be used for transmitters with up to 6 amplifiers. ● The type "32-120" should be used for transmitters with more than 6 amplifiers.	"40-100", "32-120"	Read only
Flow	Indicates the currently measured flow through the pump.	0 to 200	Read only
Speed	Indicates the currently measured speed of the pump motor.	0 to 100	
Fan (State)	Indicates whether the assigned fan is correctly registered on the fan communication bus.	not found installed	Read only
(Fan) Motor	Indicates whether the fan motor is ready for operation or is mechanically blocked.	Blocked OK	Read only

Name	Description	Value range	Access right
(Fan) Supply	If this message appears, the fan is disconnected from the power supply. Check the position of the maintenance switch on the heat exchanger; also check the circuit breaker of the fan in the mains distribution unit of the rack.	OK Failure	Read only
Inlet Temp.	Indicates the temperature of the coolant flowing into the transmitter rack.	−30 °C to +90 °C	Read only
Outlet Temp.	Indicates the temperature of the coolant flowing out of the transmitter rack toward the heat exchanger. The temperature must not exceed a maximum value of 65 °C.	−30 °C to +90 °C	Read only
Pressure	Indicates the pressure of the coolant. With the pumps switched off, this pressure can be slightly lower than when the pumps are running. The correct pressure depends on the delivery head of the pumps, the temperature of the coolant and the altitude of the operating location. Precise pressure tables can be found in the manual.	0 to 6	Read only
Antifreeze	Used to define whether or not the fans at the heat exchanger are to switch off if the temperature drops well below the specified temperature. Off: The fans switch off. This setting is recommended in order to reduce the energy consumption of the cooling system. On: The fans continue to run even at low outside temperatures. This setting is recommended if the risk of fan seizure due to freezing is to be reduced. Note: Even if antifreeze mode is active, the condensation protection function of the transmitter will still switch off the fans at an inlet temperature below approx. +10 °C. The fans are designed in such a way that they are not damaged if they seize up due to freezing.	Off; On	Configuration
Auto/On	If the switch is set to "On", the cooling system is switched on irrespective of whether or not the transmitter is on. This setting should only be used when putting the system into operation. If the switch is set to "Auto", the cooling system is switched on/off when the transmitter is switched on/off.	Cooling is always On; Cooling is switched on by Parameter "On"	Configuration

4.12.1.2 Configuring Fans and Pumps

The settings for fans are made in the following way:

For a standard cooling system with one transmitter rack, one pump unit and one heat exchanger, configuration is performed automatically. Manual configuration is only necessary in the following cases:

- More than one rack
- More than one heat exchanger per rack

1. Ensure that no pumps and fans are connected to the mains distribution board (MDB).
2. Press the following buttons: *Task View* > *Setup Cooling* > *Scan Devices*.
3. In the Scan Control field, switch *Scan Device* to "On".

4. Follow the dialog step by step by connecting one fan after the other and one pump after the other in the specified sequence to the mains distribution board (MDB) on the rear of the transmitter rack.

   Note: The status of this process is signaled by the status display in the Scan Control field:
   - off (gray) = *Scan Devices* is switched off.
   - In progress (yellow) = configuration is running
   - Finished (green) = configuration has been successfully completed; all displays in the Rack 1 and Rack 2 fields are set to *Nothing to do*.

5. Switch *Scan Device* to "Off".

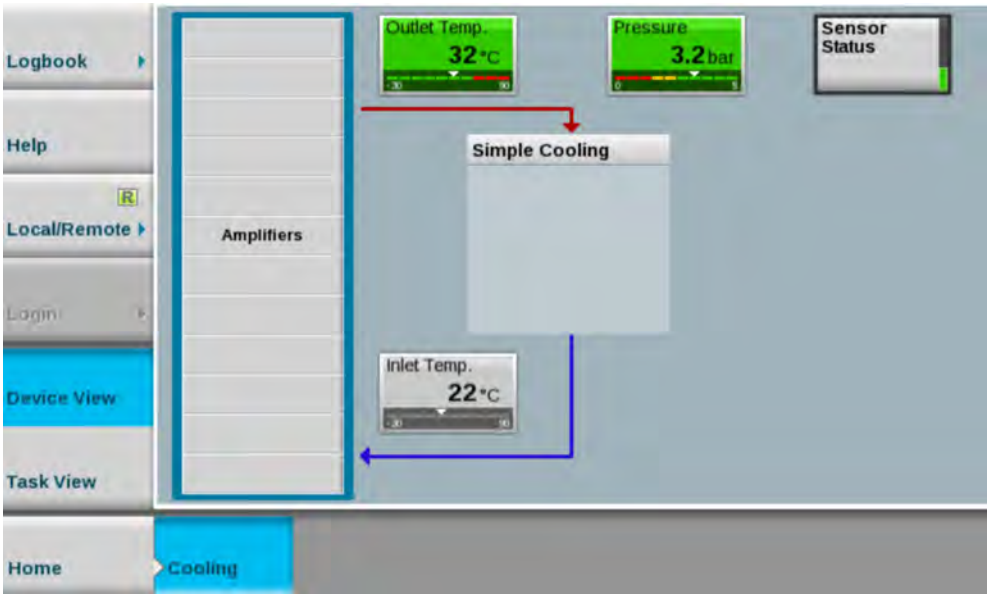
4.12.1.3 Status of Cooling System

Cooling status parameters

Name	Description	Value range	Access right
Sensor for inlet temperature	Indicates the status of the temperature sensor at the inlet of the rack. If a fault is indicated, first check the connecting cable between the sensor and the cooling interface card in the R&S TCE900 system control unit.	Green: OK Red: Sensor Fault	Read only
Sensor for outlet temperature	Indicates the status of the temperature sensor at the outlet of the rack.	Green: OK Red: Sensor Fault	Read only
Sensor for coolant pressure	Indicates the status of the pressure sensor. If a fault is indicated, first check the connecting cable between the sensor and the cooling interface card in the R&S TCE900 system control unit.	Green: OK Red: Sensor Fault	Read only
Status of coolant filter	Indicates that the pump power is not sufficient to deliver the required flow. With a correctly dimensioned and installed cooling system, this only occurs if the coolant filter is blocked.	Green: OK Yellow: Filter Warning	Read only
Sensor for overall status	Indicates whether the temperature sensors and pressure sensor are OK. A malfunction at the pressure sensor results in a fault; a malfunction at a temperature sensor results in a warning.	Green: OK Yellow: Warning Red: Fault	Read only

4.12.2 Small Cooling – Simplified Liquid Cooling System (FM Transmitter)

The following illustration shows the "Cooling" menu for "Small Cooling".



4.12.2.1 Configuration of Cooling System

The "Small Cooling" mode (simplified cooling) is used only for FM single transmitters.

- **Path:***Device View (Home) > Cooling > Task View > Setup Cooling*

Name	Description	Value range	Access right
Type	The following cooling system types can be configured: • R&S Standard If the transmitter is connected to a 9000 series cooling system, select the "R&S Standard" setting. • Site Cooling Set this configuration if the FM transmitter system is to be connected to the existing site cooling system. • R&S Small If an FM single transmitter is connected to a simplified cooling system without temperature control, use the "R&S Small" setting.	R&S Standard, Site Cooling, R&S Small	Configuration

4.12.2.2 Status

- **Path:***Device View (Home) > Cooling*

Pressing the buttons

- Outlet Temp.
- Pressure
- Sensor Status
- Inlet Temp.

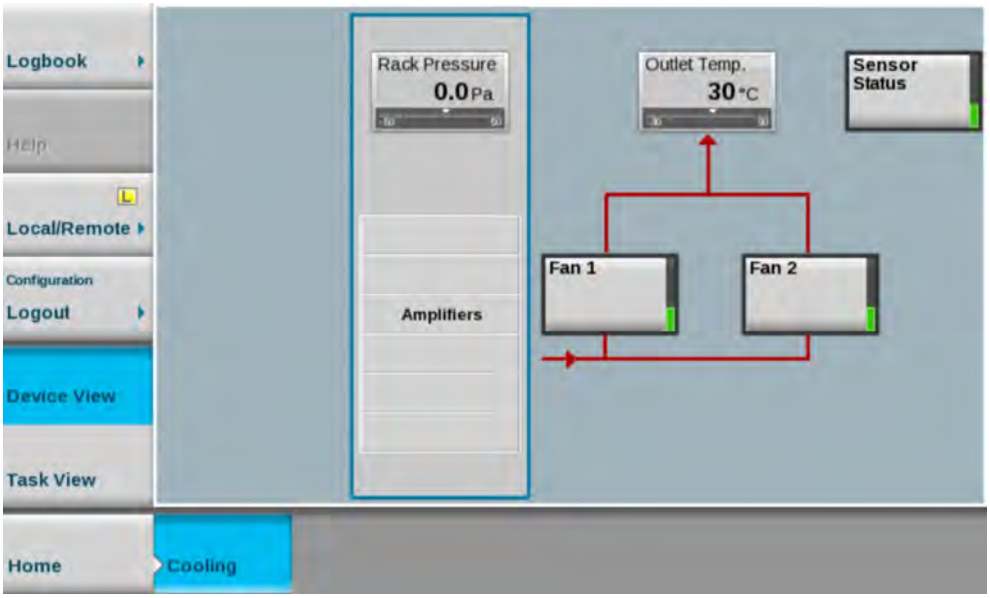
switches to the "Sensors" view or tab.

"Sensors" parameters

Name	Description	Value range	Access right
Outlet Temp. (Outlet Temperature)	Indicates the temperature of the coolant flowing out of the transmitter rack toward the heat exchanger. The temperature must not exceed a maximum value of 65 °C.	−30 °C to +90 °C	Read only
Sensor Status (Outlet Temperature)	Indicates the status of the temperature sensor at the outlet of the rack.	Off, Sensor Fault, OK	Read only
Warning Limit (Outlet Temperature)	Indicates the threshold value for a temperature warning. If the coolant temperature exceeds this value, a warning is triggered. The threshold value can be set here (in steps of 1 degree).	40 °C to 65 °C	Configuration
Fault Limit (Outlet Temperature)	Indicates the threshold value for displaying a temperature fault. If the coolant temperature exceeds this value, a corresponding temperature fault is displayed and the rack is shut down. In N+1 systems, this event can lead to switchover of the transmitter. The threshold value can be set here (in steps of 1 degree).	50 °C to 65 °C	Configuration
Inlet Temp. (Inlet temperature)	Indicates the temperature of the coolant flowing into the transmitter rack.	−30 °C to +90 °C	Read only
Sensor Status (Inlet Temperature)	Indicates the status of the temperature sensor at the inlet of the rack. If a fault is indicated, first check the connecting cable between the sensor and the cooling interface card (CIF) in the R&S TCE900 system control unit.	Off, Sensor Fault, OK	Read only
Pressure (Coolant Pressure)	Indicates the pressure of the coolant. With the pumps switched off, this pressure can be slightly lower than when the pumps are running. The correct pressure depends on the delivery head of the pumps, the temperature of the coolant and the altitude of the operating location. Precise pressure tables can be found in the system manual for the transmitter.	−500 Pa to +500 Pa	Read only
Sensor Status (Coolant Pressure)	Indicates the status of pressure sensor 1. If a fault is indicated, first check the connecting cable between the sensor and the air cooling interface card in the R&S TCE900 system control unit.	Off, Sensor Fault, OK	Read only
Warning Limit (Coolant Pressure)	Indicates the threshold value for a pressure warning. If the coolant pressure drops to this value or lower, a warning is triggered. This value should be set higher than the value for the corresponding "Fault Limit". The threshold value can be set here (in steps of 1 bar).	0.0 bar to 4.0 bar	Configuration
Fault Limit (Coolant Pressure)	Indicates the threshold value for displaying a pressure fault. If the coolant pressure drops to this value or lower, a corresponding pressure fault is displayed. This value should be set lower than the value for the corresponding "Warning Limit". The threshold value can be set here (in steps of 1 bar).	0.0 bar to 4.0 bar	Configuration

4.12.3 Air Cooling (Medium-Power)

The following illustration shows the "Cooling" menu for air cooling.



- **Path:***Device View (Home) > Cooling*

Pressing the buttons

- Rack Pressure
- Outlet Temp.
- Sensor Status

switches to the "Sensors" view or tab.

"Sensors" parameters

Name	Description	Value range	Access right
Inlet Temperature	Indicates the temperature of the air flowing into the transmitter rack (only for ducted intake air with an optional intake air kit).	−30 °C to +90 °C	Read only
Sensor Status (Inlet Temperature)	Indicates the status of the temperature sensor at the inlet of the rack. If a fault is indicated, first check the connecting cable between the sensor and the air cooling interface in the R&S TCE900 system control unit (only for ducted intake air with an optional intake air kit).	Off, Sensor Fault, OK	Read only
Outlet Temperature	Indicates the temperature of the air flowing out of the transmitter rack.	−30 °C to +90 °C	Read only
Sensor Status (Outlet Temperature)	Indicates the status of the temperature sensor at the outlet of the rack.	Off, Sensor Fault, OK	Read only
Rack Pressure	Indicates the pressure in the rack. Two differential pressure sensors (Sensor 1 and Sensor 2) measure the differential air pressure inside and outside the rack. If a sensor fails, the remaining sensor continues to indicate the pressure inside the rack.	−500 Pa to +500 Pa	Read only

Name	Description	Value range	Access right
Sensor 1 (Pressure 1)	Indicates the status of pressure sensor 1. If a fault is indicated, first check the connecting cable between the sensor and the air cooling interface card in the R&S TCE900 system control unit.	Off, Sensor Fault, OK	Read only
Sensor 2 (Pressure 2)	Indicates the status of pressure sensor 2. If a fault is indicated, first check the connecting cable between the sensor and the air cooling interface card in the R&S TCE900 system control unit.	Off, Sensor Fault, OK	Read only

"Status Fan 1/2" parameters

Name	Description	Value range	Access right
Communication	Indicates whether the data transfer from fans 1/2 to the air cooling interface (ACIF) is OK.	OK, Fault	Read only
Speed	Indicates the speed of fans 1/2 read out from the air cooling interface (ACIF).	0 % to 100 %	Read only

5 Task View Description

5.1 Basic Settings

The structure of the transmitter system is configured in the "Basic Setup" menu. Each R&S TCE900 is assigned its logical function together with the other R&S TCE900 units, the physical installation position of the individual R&S TCE900 units is set and the distribution of transmitters and R&S TCE900 units in the racks is described.

The basic settings are made for each R&S TCE900 in the system and must be entered in the specified sequence:

- Hardware equipment ("Boards" menu tab)
  The hardware modules which each R&S TCE900 contains and at which position these modules are inserted in the R&S TCE900 base unit must be configured for each R&S TCE900.
- Definition of the logical function
  The task that each R&S TCE900 is to fulfill in the system must be defined.
- Integration of the R&S TCE900 in the transmitter system
  Depending on their function, some R&S TCE900 units require additional information regarding:
  – system variant (MultiTX, N+1)
  – transmitter variant (Redundancy, Modulation, Amplifier Type)
  – assignment to a transmitter (TX Number, Exciter A/B)
- Physical structure of the transmitter system
  Depending on their function, some R&S TCE900 units require additional information regarding:
  – total number of transmitter racks
  – number of racks per transmitter
- Physical installation location of the R&S TCE900 units
  Each R&S TCE900 must be assigned the following:
  – number of the rack in which the R&S TCE900 is installed
  – number of the installation slot within a rack
- Assignment of transmitters to racks ("Racks" menu tab)
  Each R&S TCE900 with the "Rack Control" function must be assigned those transmitters which are installed in the racks that the "Rack Control" function monitors.

Changes to the basic settings only become effective when the R&S TCE900 has been restarted.

In the tables below, "?" means that it must be taken into consideration whether an air cooling interface (ACIF) or a TX interface is installed. See the detailed description of the "Cooling Control" and "Rack Control" parameters in the table "**Description of setting values**".

Assignment of logical functions

Table 5-1: "Functions" for SingleTX systems (for TMU9 and TMV9 only)

Transmitter type	System Control	TX Control	Exciter	Cooling Control	Rack Control
Single drive					
Exciter	X	X	X	?	?
Backup drive					
Exciter A	X	X	X	?	?
Exciter B	-	X	X	-	-
Dual drive					
System Control	X	-	-	?	?
Exciter A	-	X	X	-	-
Exciter B	-	X	X	-	-

Table 5-2: "Functions" for MultiTX systems (<n> = 1 to 8)

Transmitter type	System Control	TX Control	Exciter	Cooling Control	Rack Control
Single drive					
System Control	X	-	-	?	X
Exciter (TX <n>)	-	X	X	-	-
Dual drive					
System Control	X	-	-	?	X
Exciter A (TX <n>)	-	X	X	-	-
Exciter B (TX <n>)	-	X	X	-	-

Table 5-3: "Functions" for N+1 systems (<n> = 1 to 8; TXB: <n> = 9)

Transmitter type	System Control	TX Control	Exciter	Cooling Control	Rack Control
Single drive					
System Control	X	-	-	?	X
Exciter (TX A<n>, TX B)	-	X	X	-	-
Rack Control (where applicable)	-	-	-	-	X
Dual drive					
System Control	X	-	-	?	X
Exciter A (TX A<n>, TX B)	-	X	X	-	-

Transmitter type	System Control	TX Control	Exciter	Cooling Control	Rack Control
Exciter B (TX A<n>, TX B)	-	X	X	-	-
Rack Control (where applicable)	-	-	-	-	X

Table 5-4: "Setup" for SingleTX systems (for TMU9 and TMV9 only)

Transmitter type	System Variant	TX Number	Exciter	Redundancy	No. of Transmitters
Single drive					
Exciter	SingleTX/MultiTX	A1	A	Single drive	1
Backup drive					
Exciter A	SingleTX/MultiTX	A1	A	Backup drive	1
Exciter B	-	A1	B	Backup drive	1
Dual drive					
System Control	SingleTX/MultiTX	-	-	-	1
Exciter A	-	A1	A	Dual drive	-
Exciter B	-	A1	B	Dual drive	-

Table 5-5: "Setup" for MultiTX systems (<n> = 1 to 8)

Transmitter type	System Variant	TX Number	Exciter	Redundancy	No. of Transmitters
Single drive					
System Control	SingleTX/MultiTX	-	-	-	<n>
Exciter (TX <n>)	-	A<n>	A	Single drive	-
Dual drive					
System Control	SingleTX/MultiTX	-	-	-	<n>
Exciter A (TX <n>)	-	A<n>	A	Dual drive	-
Exciter B (TX <n>)	-	A<n>	B	Dual drive	-

Table 5-6: "Setup" for N+1 systems (<n> = 1 to 8; TXB <n> = 9)

Transmitter type	System Variant	TX Number	Exciter	Redundancy	No. of Transmitters
Single drive					
System Control	N+1 TX	-	-	<n>	
Exciter (TX A<n>, TX B)	-	A<n>	A	Single drive	-

Transmitter type	System Variant	TX Number	Exciter	Redundancy	No. of Transmit-ters
Rack Control (where appli-cable)	-	-	-	-	
Dual drive					
System Control	N+1 TX	-	-	-	<n>
Exciter A (TX A<n>, TX B)	-	A<n>	A	Dual drive	-
Exciter B (TX A<n>, TX B)	-	A<n>	B	Dual drive	-
Rack Control (where appli-cable)	-	-	-	-	-

Table 5-7: IP addresses for SingleTX systems (for TMU9 and TMV9 only)

Transmitter type	Ethernet Local
Single drive	
Exciter	192.168.58.100
Backup drive	
Exciter A	192.168.58.11
Exciter B	192.168.58.12
Dual drive	
System Control	192.168.58.100
Exciter A	192.168.58.11
Exciter B	192.168.58.12

Table 5-8: IP addresses for MultiTX systems (<n> = 1 to 8)

Transmitter type	Ethernet Local
Single drive	
System Control	192.168.58.100
Exciter (TX <n>)	192.168.58.<n>1
Dual drive	
System Control	192.168.58.100
Exciter A (TX <n>)	192.168.58.<n>1
Exciter B (TX <n>)	192.168.58.<n>2

Table 5-9: IP addresses for N+1 systems (<n> = 1 to 8; TXB <n> = 9; <m> = 2 to 9, No. of Rack Controls)

Transmitter type	Ethernet Local
Single drive	
System Control	192.168.58.100
Exciter (TX A<n>, TX B)	192.168.58.<n>1
Rack Control (where applicable)	192.168.58.10<m>
Dual drive	
System Control	192.168.58.100
Exciter A (TX A<n>, TX B)	192.168.58.<n>1
Exciter B (TX A<n>, TX B)	192.168.58.<n>2
Rack Control (where applicable)	192.168.58.10<m>

Table 5-10: Description of setting values

Name	Description	Value range	Access right
System Control	Set this check mark if this cassette of the R&S TCE900 is to function as a system control unit. In this case, all remote control interfaces and (if present) a R&S TDU900 display unit must be connected to this R&S TCE900. This R&S TCE900 can also perform the function of the N+1 automatic system. In addition to functioning as a system control unit, other functions can also be assigned to the same R&S TCE900 depending on the modules it contains.	Disabled, Enabled	Configuration
TX Control	Set this check mark if this cassette of the R&S TCE900 cassette is to function as a transmitter control unit. The transmitter control unit contains, for example, the function for monitoring the output power and an automatic exciter switchover function (optional). In addition to functioning as a transmitter control unit, other functions can also be assigned to the same R&S TCE900 depending on the modules it contains. This function must always be activated together with the "Exciter" function on the same R&S TCE900.	Disabled, Enabled	Configuration
Exciter	Set this check mark if this R&S TCE900 cassette contains at least one coder board and one RF board. With a R&S TCE900 which is configured as an exciter, the "TX Control" function must be activated at the same time, unless the R&S TCE900 exciter is to be operated as a standalone instrument. In addition to functioning as an exciter, other functions can also be assigned to the same R&S TCE900 depending on the modules it contains.	Disabled, Enabled	Configuration
Cooling Control	Set this check mark if this R&S TCE900 cassette contains at least one cooling interface or one air cooling interface. In addition to functioning as a cooling control unit, other functions can also be assigned to the same R&S TCE900 depending on the modules it contains. The "Cooling Control" function must always be activated together with the "Rack Control" function on the same R&S TCE900.	Disabled, Enabled	Configuration

Name	Description	Value range	Access right
Rack Control	Set this check mark if this R&S TCE900 is to monitor rack components (e.g. overvoltage protection) or door contacts. A "TX Interface" module must be installed in the R&S TCE900. With most system configurations, the Rack Control function is together with the System Control function on the same R&S TCE900. The only exception are multirack N+1 systems in which more than one Rack Control are installed. With THx9, the "Rack Control" function must always be activated together with the "Cooling Control" function on the same R&S TCE900. With TMx9, the Rack Control function must be activated if an air cooling interface is installed in the R&S TCE900 and the "Cooling" function is activated.	Disabled, Enabled	Configuration
System Variant	Indicates whether the system is a SingleTX, MultiTX or N +1 system. The setting can be changed here if the "System Control" function is active.	Single/ MultiTX, n+1	Configuration
TX Number	Indicates the transmitter to which this R&S TCE900 is assigned. The setting can be changed here if the "TX Control" function is active.	TX A1 to TX A8 + TXB	Configuration
Exciter	Indicates whether this R&S TCE900 is to operate as exciter A or exciter B. The displayed value must correspond to the cabling of the two exciters at the exciter switch. Exciter A is shown in the case of single drive transmitters. The setting can be changed here if the "Exciter" function is active.	Exc A, Exc B	Configuration
ParIO	Indicates whether remote control has been activated by means of parallel contacts. ParIO 32/80 corresponds to a parallel remote control interface card with 32 inputs and 80 outputs. ParIO 9/12 corresponds to a parallel remote control interface card with 9 inputs and 12 outputs. Remote control can be connected to a R&S TCE900 with the System Control function. In the case of N+1 systems, it is also possible to connect remote control to a R&S TCE900 with the TX Control function, but certain restrictions will then apply. The setting can be changed here if the "System Control" or "TX Control" function is active.	Off, 32/80, 9/12	Configuration
Redundancy	Indicates which redundancy method is supported by this transmitter. ● Single Drive: The transmitter contains one exciter. ● Dual Drive: The transmitter contains two exciters. If the active exciter fails, an automatic switchover function switches the system over to the standby exciter. ● **Only available with some system variants:** Backup Drive: The transmitter contains two exciters. If the active exciter fails, an automatic switchover function switches the system over to the standby exciter. The setting can be changed here if the "TX Control" function is active.	Single Drive, Dual Drive, Backup Drive	Configuration

Name	Description	Value range	Access right
Transmitters	Indicates how many transmitters the system contains. The B transmitter of an N+1 system is not included here. The setting can be changed here if the "System Control" function is active.	1 to 8	Configuration
Modulation	Indicates the modulation mode of the exciter. An appropriate software option must additionally be installed for the displayed modulation mode. Either the modulation modes for TV/DAB or those for FM/FMHD are available. The setting can be changed here if the "TX Control" or "Exciter" function is active.	DVB-T2, DVB-T, ISDB-T, ATSC, ATV, DAB, FM, FMHD	Configuration
Rack Number	Indicates the rack in which the R&S TCE900 module is installed. The left-hand rack is assigned the number 1. The setting can be changed here if the "System Control", "TX Control" or "Exciter" function is active.	1 to 18	Configuration
Amplifier Mode	Indicates whether the amplifiers are to be operated in broadband or Doherty mode. To operate the amplifiers in Doherty mode, the frequency ranges of the amplifiers must be set to the transmit frequency. This display only applies to amplifier types which support Doherty mode. The setting can be changed here if the "TX Control" or "Exciter" function is active.	Broadband, Doherty	Configuration
Amplifiers	Indicates the total number of amplifiers per output stage of this transmitter. Whether the amplifiers are housed in one or more racks is irrelevant. Up to 24 amplifiers per output stage are supported (FM: up to 8 amplifiers). The setting can be changed here if the "TX Control" function is active.	1 to 24	Configuration
Amplifier Type	Indicates the amplifier type used in the transmitter. ● PHU901: High-power amplifier, UHF, liquid-cooled. ● PMU901: Medium-power amplifier, UHF, air-cooled with Doherty mode. ● PHU902: High-power amplifier, UHF, liquid-cooled with Doherty mode. ● PHV902: High-power amplifier, VHF, liquid-cooled with Doherty mode. ● PMV901: Medium-power amplifier, VHF, air-cooled with Doherty mode. The setting can be changed here if the "TX Control" or "Exciter" function is active.	PHU901, PMU901, PHU902, PHV902, PMV901, PHR901, PMR901	Configuration
Slot Number	Indicates the position at which the R&S TCE900 is installed in the respective rack. In the THU9, position 1 is the left-hand slot; in the TMU9, position 1 is the top slot. The setting can be changed here if the "System Control", "TX Control" or "Exciter" function is active.	1 to 12	Configuration

Name	Description	Value range	Access right
Racks/Rack Control	Indicates how many racks are monitored by this R&S TCE900. Transmitters with more than 12 amplifiers monitor 2 racks with one rack control. With all other transmitters, this value must be set to 1. The setting can be changed here if the "Rack Control" function is active.	1 or 2	Configuration
Cooling Type	Indicates the type of cooling system. The displayed value must be suitable for the amplifier type. Further settings are made in the "Home" > "Cooling" > "Task View" > "Setup Cooling" menu.	Liquid, Air	Configuration
Racks/ System	Indicates the total number of racks contained in the system. The setting can be changed here if the "System Control" function is active.	1 to 18	Configuration
Racks/TX	Indicates the number of racks that the transmitter consists of. This setting is only relevant for THU9 transmitters with more than 12 amplifiers. In all other cases, the value 1 must be set here. The setting can be changed here if the "TX Control" function is active.	1 to 4	Configuration
Number of Rack Controls	Indicates the total number of rack controls which are active in the system. The setting can be changed here if the "Rack Control" function is active.	1 to 9	Configuration
Int. RF Sensor	Indicates whether the internal RF test point of the amplifier is to be used for measuring the transmit power. The setting is only relevant for "Amplifier Type = PMU901". The value "On" should be set if the transmitter consists of exactly one amplifier and no CAN bus test point is installed in the transmitter. The setting can be changed here if the "Rack Control" function is active.	Off, On	Configuration
Configuration	Indicates whether the selected combination of settings is valid and nonconflicting. The setting can be changed here.	OK, not Valid	Read only
Reboot	Reboots this R&S TCE900. Changes to settings in this and the other menu tabs of the Basic Config menu only become effective after a reboot.		Configuration
IP Address (Local IP Settings)	Used to set the IP address of the R&S TCE900 for internal communications with other R&S TCE900 units in this system. When the system is supplied, the internal IP addresses begin with 192.168.58. The last group of digits differs according to the following rule: ● System Control: 100 ● TX Control + Exciter: 11/12 (= TXA1, Exciter A/B) to 81/82 (= TXA8, Exciter A/B); 91/92 (= TXB, Exciter A/B) ● Rack Control (second rack): 101 The setting can be changed here.		Configuration

Name	Description	Value range	Access right
IP Address (Remote IP Settings)	Used to set the IP address of the R&S TCE900 system control. The settings depend on the network infrastructure.		
Slot Config	Used to determine which module is contained in each installation slot of the R&S TCE900 unit. Basically, any module can be inserted into any installation slot. The rack cabling has, however, been optimized for installation of the modules in the following slots: ● Slot A (bottom left): RF board or TX interface ● Slot B (top center): Cooling interface (CIF or ACIF) or ATV interface ● Slot C (bottom center): Reserved for receiver module ● Slot CD (top right): Coder board or LAN switch The setting can be changed here.	Coder Board, RFBoard, TXIf, CoolingIf, LANSwitchIf, ATVIf, CIF, ACIF	Configuration

5.2 Parameters: Input Configuration

GUI name (external)	Help text (English)	Value range	Value access
Input Source	Here, you can configure the input interfaces used for two inputs, independently of each other. To test the "seamless switching" function, it is possible to select the same input interface for both inputs. The selection options of the data sources are determined by the installed Input Interfaces and option keys.	variable	Maintenance
Multiplex Name	Here, you can assign any desired name for the multiplex contained in this transport stream. This name is displayed in the transmitter overview and, for n+1 systems, in the automatic transmitter.		Maintenance
Mute (on Input Fail)	Here, you can configure the operating behavior when the active input fails. This parameter is available in MFN operating mode only. ● No – In the operating mode, the output signal is not suppressed if the active input fails. Null packets are output instead. ● Yes - If the active input fails, the output signal is suppressed.	No, Yes	Maintenance
Input Fail Delay	Used to set a delay time which must elapse following an input signal failure before the output signal is suppressed and a sum fault is generated.		Maintenance
Force Exciter Changeover	Here it can be determined whether switchover to another redundant exciter is to take place if the input signal fails. This function is available for all redundancy systems (dual drive, backup exciter and n+1). ● Yes - In the "Yes" position, an exciter fault is signaled to the higher-level redundancy control unit which decides whether to switch over to another exciter or transmitter. ● No - In the "No" position, no switchover takes place.	Yes, No	Maintenance
Monitor Out	Here, for measuring purposes, you can send any input signal to the TS Monitor-Out jack (X22). The selection options of the data sources are determined by the installed Input Interfaces and option keys.		Maintenance
IP Stream	Indicates whether a valid data stream is fed to the transmitter via the IP feed. If an error is indicated, check the settings of the IP stream and the Ethernet interface.		Query

GUI name (external)	Help text (English)	Value range	Value access
TS Stream	Indicates whether a valid serial data stream is fed to the transmitter via TS1/2 IN (X20/X21). If an error is displayed here, first check the setting of the TS type (ASI/SMPTE).		Query
RJ45 Connector	Here, define the physical network interface to which the logical IP stream is bound. Normally, the TS LAN 1(X30) jack is coupled to IP Stream 1 and TS LAN 2(X31) is coupled to IP Stream 2. This allows you to use multiple redundant servers that can be selected automatically using the automatic input signal switchover. However, it is also possible to select multiple multicast streams via the same physical Ethernet jack. In this case, too, the automatic input signal switchover can toggle automatically between two data streams.	• TS LAN1 • TS LAN2	Maintenance
Streaming Mode	This configures the type of network streaming. • Unicast: The multiplex sends the suitable IP stream to the IP address of the TV transmitter in a targeted manner. • Multicast: The TV transmitter subscribes to a Multicast IP stream that can be provided by the Multiplexer in the feed network to multiple transmitters at the same time.	• Unicast • Multicast	Maintenance
Multicast Address	The function of this menu item varies depending on the selected streaming mode: • for Unicast: displays the local IP address of the selected input X30 or X31. • for Multicast: used to set the multicast address of the required gateway server (data transmitter).		Maintenance
Port	Used to set the port number under which the transport stream is expected.		Maintenance
Protocol	Select the network protocol used here. • UDP (User Datagram Protocol) for easy connectionless communication. • RTP (Realtime Transport Protocol) for packet-oriented communications.		Maintenance
Packet Lock	Indicates that a signal has been detected at this input.		Read only
Packet Length	Indicates the dedicated packet length of the transport stream.		Read only
Gross IP data rate	Shows the total data rate at the IP feed.		Read only
TS State	Indicates whether a valid serial data stream is fed to the transmitter via the TS1/2 IN (X20/X21) jacks. If an error is displayed here, first check the setting of the TS type (ASI/SMPTE).		Read only
Type	Used to set the data format for the data streams at X20 and X21. • AUTO: Data format is detected automatically • ASI: Manual setting for an ASI transport stream • SMPTE: Manual setting for an SMPTE transport stream	• Auto • ASI • SMPTE	Maintenance
Gross TS Datarate	Shows the total data rate at the TS feed.		Read only

5.3 System Control

5.3.1 Simple Network Management Protocol (SNMP)

To operate the transmitter in SNMP mode, an appropriate software option must be activated using an option key.

5.3.1.1 General

Simple network management protocol (SNMP) is used for monitoring and controlling different devices in a network. A description of the device must be loaded in the central unit ("manager"; management information base (MIB)), from which the transmitters are monitored. A monitored device contains a program ("agent") that can answer queries from the manager and execute commands. Furthermore, it is possible that the agent of its own accord generates a message (called a notification, alarm or trap) and sends it to the manager. In this way, the central unit can be informed of a fault. The MIBs required for monitoring and controlling a transmitter are stored as a ZIP archive in every R&S TCE900. From there, they can be downloaded with any web browser. When the transmitter is put into operation, both the agent in the transmitter and the manager must be configured. Additional steps may be necessary if the transmitter is connected via routers, firewalls or similar devices, as they may block data packets.

5.3.1.2 Settings on Transmitter End

You can make settings yourself via the local R&S TDU900 display (if available), via the web server or in part via SNMP. The Task View > System Control > SNMP menu contains all the settings that are required for accessing a transmitter.

Changes to these settings are adopted immediately. The device does not need to be restarted.

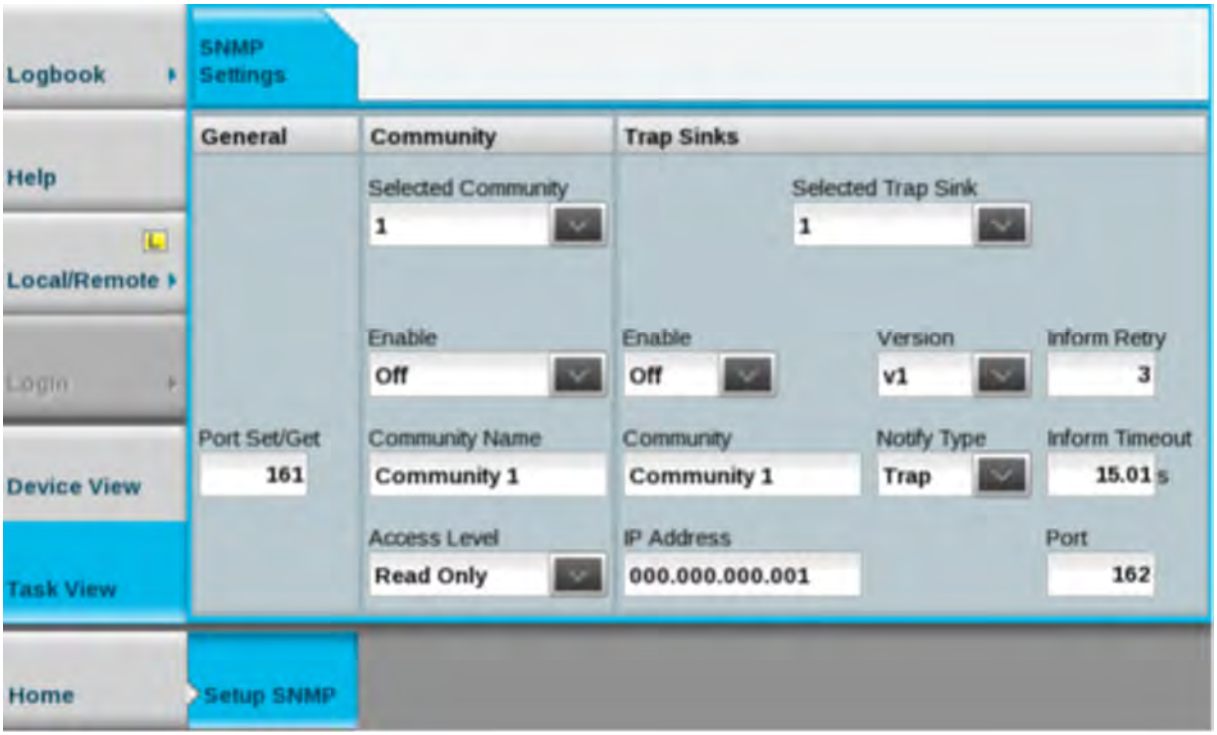


Fig. 5-1: SNMP menu

The XX9 transmitter family supports the versions SNMPv1 and SNMPv2c. Alarms can be sent as v1Traps, v2Traps or v2Informs. Several destinations for error messages (trapsinks) and several communities can be set with read only authorization and read/write authorization. SNMP is a protocol for remote control and is offered only at the remote Ethernet interface (X2 – 1000 BaseT). The system or transmitter has to be set to remote to execute SET commands.

5.3.1.3 Settings on Manager End

The basic SNMP settings (port, community) on the manager end and transmitter end have must match. You typically define these settings for each IP address in your program (e.g. MIB browser). The SNMP version is also set in the manager; the transmitter then detects this automatically. Subsequently, SNMP communications should already be functioning at a basic level.

Fig. 5-2: SNMP manager settings

Being able to monitor and control a transmitter with SNMP requires the device's MIB on the manager end and a program that can interpret the MIB. You can load all available MIBs from any device using a web browser.

- Log in using the WebGUI and select the menu Task View > System Control > Downloads > Download SNMP MIBs
- Save the mibs.zip file to your computer
- Load the following MIBs in the MIB browser:
  - RS-COMMON-MIB
  - RS-XX9-SMI-MIB and RS-XX9-TC-MIB
  - RS-XX9-COMMON-MIB
  - MIB of the standby concept, standard or option

A detailed description of the MIBs, the information that they contain and the associated options is given below.

MIBs from Rohde & Schwarz and the Munich-based Broadcast Technology Institute (IRT) are available. MIBs from IRT allow transmitters to be linked using SNMP irrespective of the manufacturer. They are, however, limited with respect to their functionality. Some particular features to keep in mind when using IRT MIBs are listed in the document "SoftwareMiniSpecification – SNMP for XX9".

The MIBs have the naming convention RS-XX9-<TV/radio standard>-<function/option>-MIB. Examples include: RS-XX9-DVBT2-MIB for DVB-T2 and RS-XX9-AIR-COOLING-MIB for air cooling.

Examples of MIBs and contents

MIB	Description
RS-COMMON-MIB	Contains general Rohde & Schwarz definitions
RS-XX9-SMI-MIB	Contains top-level definitions of other XX9 MIBs
RS-XX9-TC-MIB	Contains definitions for textual conventions used in other MIBs
RS-XX9-COMMON-MIB	Contains definitions that comply with all of the transmitters from the XX9 family (e.g. configuration)
RF-XX9-TX-MIB	Contains definitions for single transmitters not dependent on the TV standard
RF-XX9-MTX-MIB	Contains definitions for MultiTx and N+1 systems

5.3.1.4 Which MIBs Must Be Used?

The device can be queried by SNMP in order to find out which MIBs have been implemented. This information is contained in the table "sysORTable" (OID .iso(1).org(3).dod(6).internet(1).mgmt(2).mib-2(1).system(1).sysORTable(9) of the SNMPv2 MIB). There is a corresponding MIB for each type of modulation.

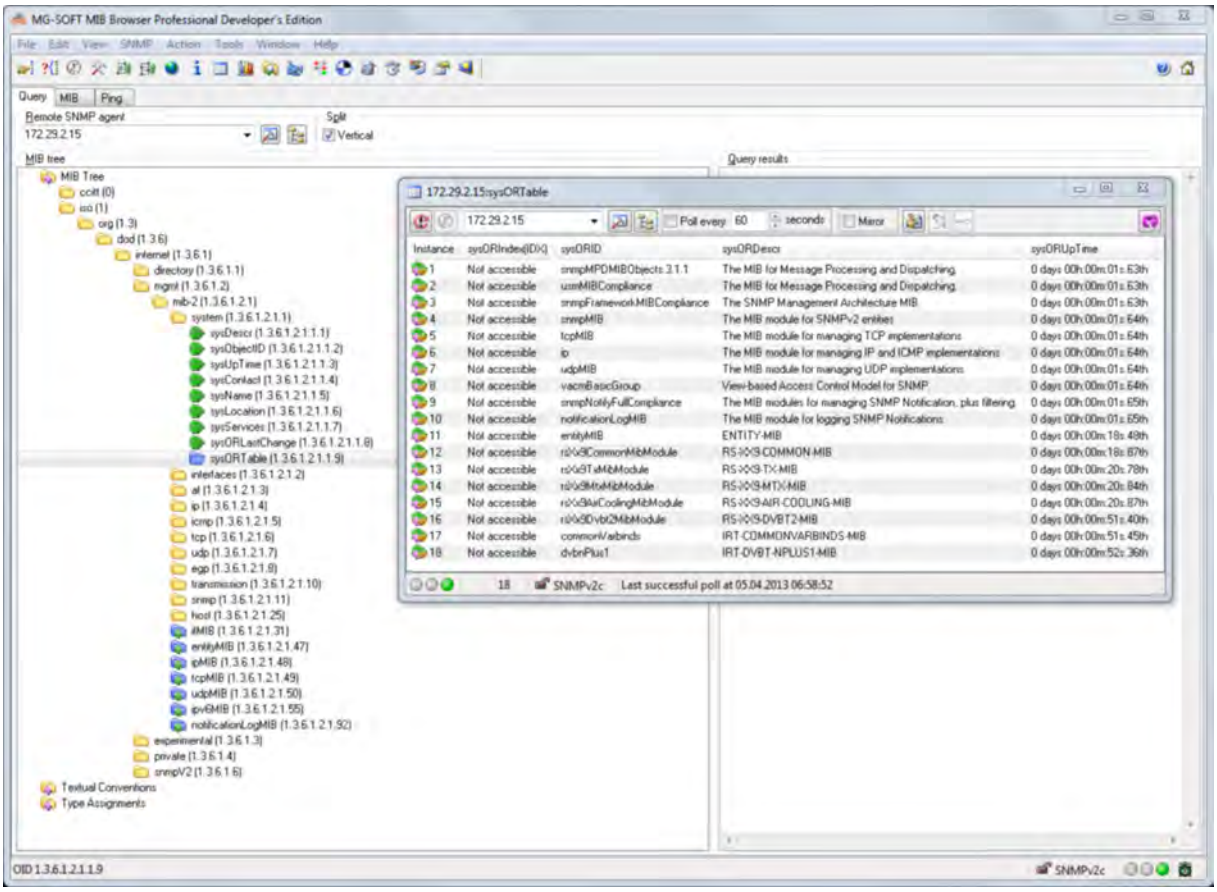


Fig. 5-3: sysORTable display

MIB	Description
RS-COMMON-MIB	This MIB contains general Rohde & Schwarz definitions.
RS-XX9-AIR-COOLING-MIB	This MIB contains parameters for air-cooled transmitters.
RS-XX9-COMMON-MIB	This MIB contains general data that supports every device: ● Transmitter configuration ● Option keys ● Software update ● SNMP configuration ● Releasing a test notification This information always applies to the device using SNMP.
RS-XX9-LIQUID-COOLING-MIB	This MIB contains parameters for liquid-cooled transmitters, either with internal Rohde & Schwarz cooling or with (external) station cooling.
RS-XX9-MTX-MIB	This MIB contains parameters independent of the type of modulation for: ● MultiTx ● N+1
RS-XX9-SMI-MIB	This MIB contains top-level definitions of other XX9 MIBs.
RS-XX9-TC-MIB	This MIB contains definitions for textual conventions used in other MIBs.
RS-XX9-TX-MIB	This MIB contains parameters independent of the type of modulation for: ● Single drive standby concepts ● Passive dual drive ● Active dual output stage This applies to all power classes in the medium- and high-power range.
RS-XX9-ATSC-MIB	This MIB contains parameters for ATSC signal processing.
RS-XX9-ATV-MIB	This MIB contains parameters for ATV signal processing.
RS-XX9-DAB-MIB	This MIB contains parameters for DAB signal processing.
RS-XX9-DTMB-MIB	This MIB contains parameters for DTMB signal processing.
RS-XX9-DVBT-MIB	This MIB contains parameters for DVBT signal processing.
RS-XX9-DVBT2-MIB	This MIB contains parameters for DVBT2 signal processing.
RS-XX9-FM-MIB	This MIB contains parameters for FM signal processing.
RS-XX9-ISDBT-MIB	This MIB contains parameters for ISDBT signal processing.

5.3.1.5 Which OIDs from a MIB Must Be Used?

Different parameters are available depending on the system being queried. For example, txExcAutoOperationMode (in RS-XX9-TX-MIB) returns the response NoSuchName when you query a single transmitter, since it has no automatic exciter switchover. It is easy to find out which parameters are valid by checking the conformance statements. In the example for automatic exciter switchover above, the OID txExcAutoOperationMode is contained in the txObjsExciterAutomatic object group.

For N+1 systems this also means that unavailable parameters may receive the response NoSuchName, e.g. parameters from the transmitter A8 if only a 4+1 system is present.

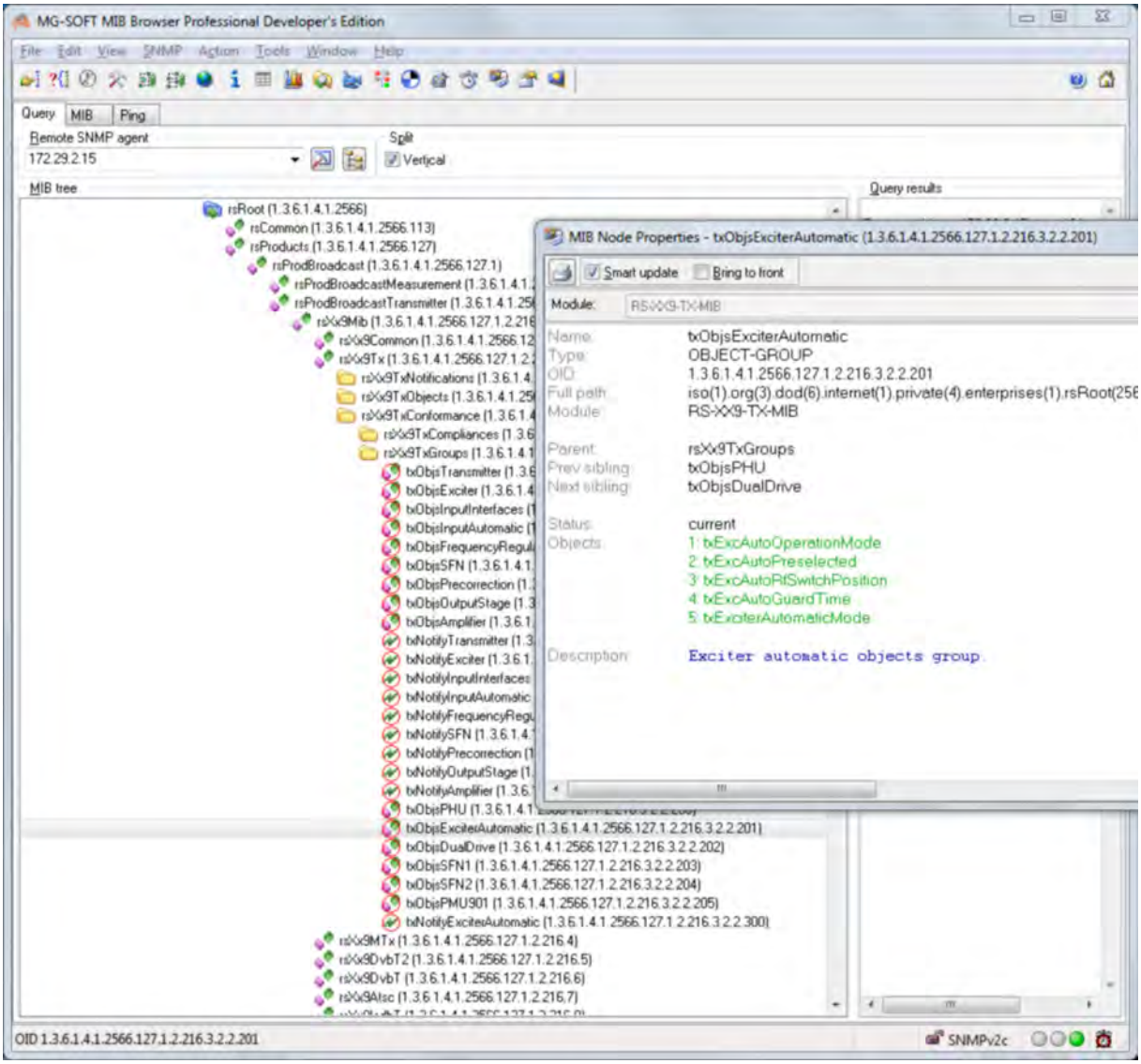


Fig. 5-4: Groups display

5.3.1.6 Setting Alarms

Parameters that allow configuration of the transmitter alarms can be found under the OID "commonSnmpConfiguration". For example, it is possible to switch off the IRT alarms (factory default setting: on) and to switch on Rohde & Schwarz alarms (factory default setting: off). The transmitter-specific alarms offer an extensive range of configuration possibilities. In addition, it is also possible to assign a user-selectable priority and to check the current status. Since the Rohde & Schwarz MIBs contain a large number of alarms, three predefined groups for faults, warnings and information exist, to

which all alarms are assigned. For each alarm, the respective alarm class is given in the binding AlarmClass.

A possible and recommended configuration would therefore be to disable the IRT alarms and to enable the Rohde & Schwarz alarms of the fault class:

- irtNotificationsAllOff: OID 1.3.6.1.4.1.2566.127.1.2.216.2.1.3.3.0
- rsNotificationsAllFaultsOn; OID 1.3.6.1.4.1.2566.127.1.2.216.2.1.3.6.0

The example shows alarm class fault (1) for the alarm "txSummaryFault" (transmitter sum fault).

Alarms are always collected in the Notifications branch in the MIBs. They always have at least three bindings.

- Alarm Class: Predefined, fixed alarm class
- Priority: User-selectable priority
- State: Current state of the alarm

"State" is defined in NotificationState in the MIB RS-XX9-TC-MIB:

undefined(1)	State is not available
off(2)	Alarm is inactive or not available
fault(3)	Alarm corresponds to an error
warning(4)	Alarm corresponds to a warning
ok(5)	Alarm does not correspond to either an error or a warning or alarm is OK

Matching the alarms, there are one or more notification tables in the MIBs on the Objects branch. Information is displayed together there.

5.3.1.7 Testing the SNMP Communications

In the following example, a transmitter with the IP address 172.29.12.43 queries the OID sendTestNotification (1.3.6.1.4.1.2566.127.1.2.216.2.1.3.1). The response from the agent is "idle(1)". Using a further test, you can check whether the transmitter sends an alarm message in the event of an error and whether this message reaches the alarm destinations. To do so, set an OID sendTestNotification to the value of 2 (trigger), which triggers a commonTest trap (1.3.6.1.4.1.2566.127.1.2.216.2.0.1000). This alarm is sent to all receivers that have been entered for the alarms (trapsinks, see above). This type of error message functions in a slightly different way than that used for querying and setting values (default: UDP Port 161 for SET/GET and UDP Port 162 for alarms).

The following image shows that the testTrap has been received correctly by the tce900-100100 device (serial number 100100).

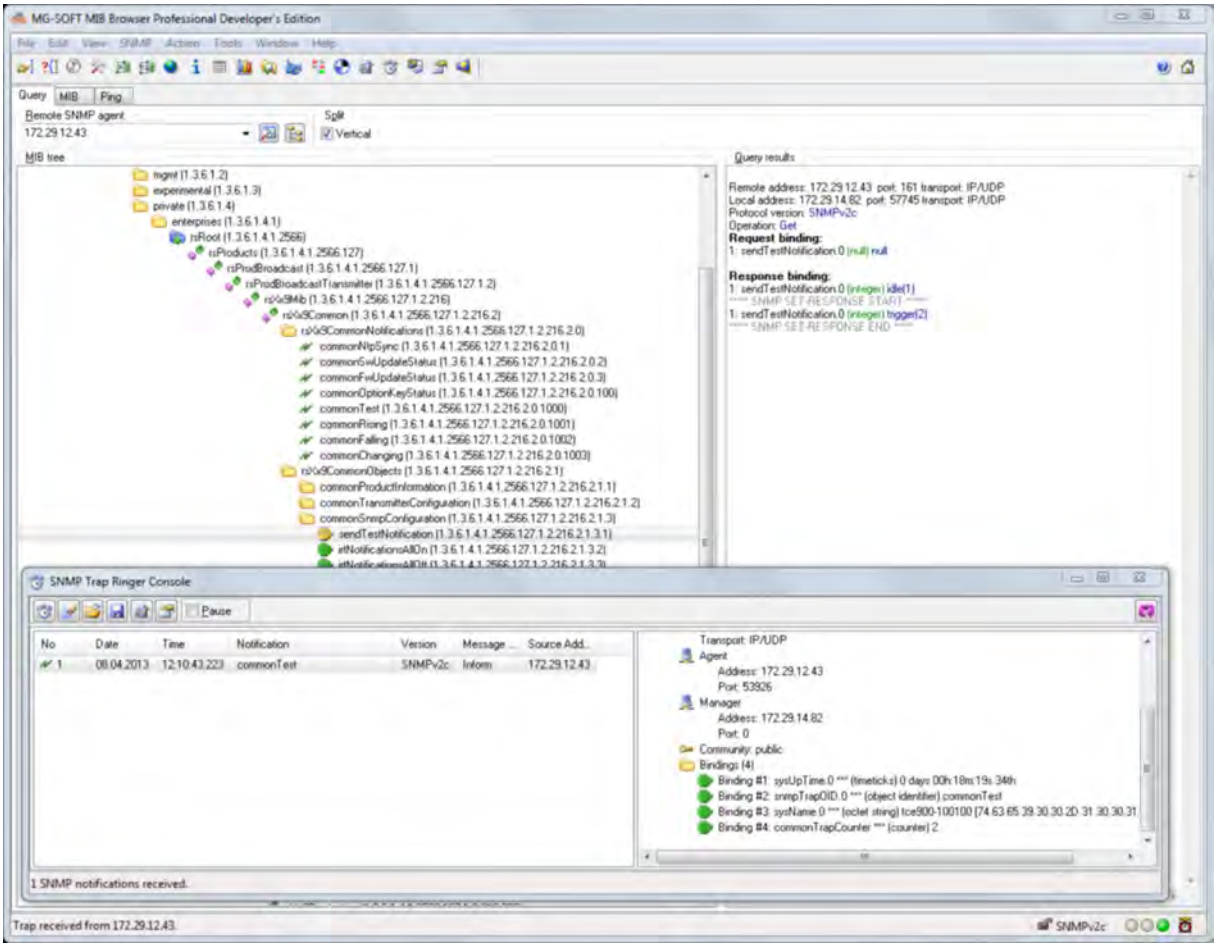


Fig. 5-5: testTrap display

5.3.1.8 Setting Alarms Using SNMP

As an alternative to a web browser, you can also configure trapsinks with SNMP as well. The procedure is described in RFC 3413.

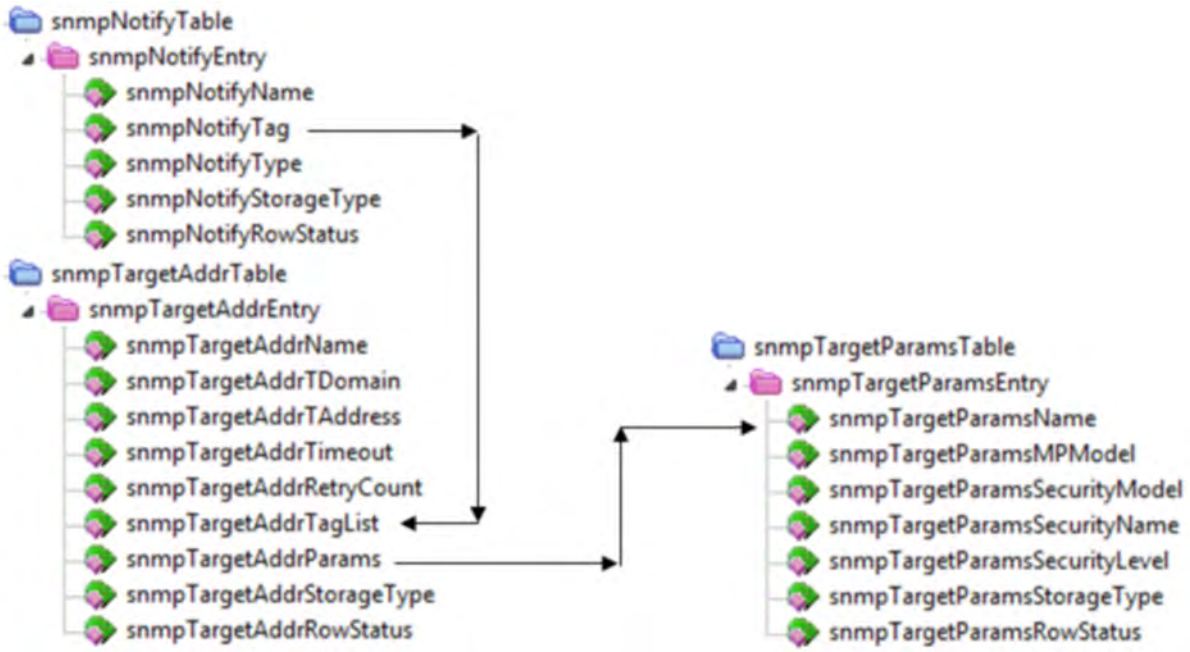


Fig. 5-6: TargetTables display

There are three tables to be used, contained in SNMP-TARGET-MIB and SNMP-NOTIFICATION-MIB: snmpNotifyTable, snmpTargetAddrTable and snmpTargetParamsTable:

- snmpNotifyType: trap(1) or inform(2)
- snmpTargetAddrTDomain / snmpTargetAddrTAddress: Address snmpTargetAddrTDomain: 1.3.6.1.6.1.1 (snmpUDPDomain), this makes snmpTargetAddrTAddress six octets; the first four octets correspond to the IP address and the last two to the UDP port
- snmpTargetAddrTimeout, snmpTargetAddrRetryCount: Additional settings for inform
- snmpTargetParamsMPModel: 0 (SNMPv1) or 1 (SNMPv2c)
- snmpTargetParamsSecurityModel: Currently just 2 (SNMPv2c)
- nmpTargetParamsSecurityName: Example: public
- snmpTargetParamsSecurityLevel: Currently just noAuthNoPriv(1)

The SNMP agent uses the following default values:

snmpNotifyName	**rsdef1**	**rsdef2**
snmpNotifyTag trap inform	trap	inform
snmpNotifyType trap(1) inform (2)	trap(1)	inform (2)
snmpNotifyStorageType nonVolatile(3) nonVolatile(3)	nonVolatile(3)	nonVolatile(3)
snmpNotifyRowStatus readOnly (5) readOnly (5)	readOnly	readOnly(5)

getAddrName	target1	to	target5
snmpTargetAddrTDomain	3.6.1.6.1.1		1.3.6.1.6.1.1
snmpTargetAddrTAddress	0x0101010100a2		0x0101010100a2
snmpTargetAddrTimeout	1500		1500
snmpTargetAddrRetryCount	3		3
snmpTargetAddrTagList	trap		trap
snmpTargetAddrParams	param2		param2
snmpTargetAddrStorageType	permanent(4)		permanent(4)
snmpTargetAddrRowStatus	notInService(2)		notInService(2)

snmpTargetParamsName	param1	param2
snmpTargetParamsMPModel	0	1
snmpTargetParamsSecurityModel	1	2
snmpTargetParamsSecurityName	public	public
snmpTargetParamsSecurityLevel	nNoPriv(1)	noAuthNoPriv(1)
snmpTargetParamsStorageType	permanent(4)	permanent(4)
snmpTargetParamsRowStatus	active(1)	active(1)

5.3.1.9 Type plates - the ENTITY MIB

The ENTITY MIB contains information on type plates. The table commonEntPhysicalTable in RS-XX9-COMMON-MIB serves as an extension of this. It includes values such as operating hour meters and the number of restarts.

The following figure shows an excerpt from the table entPhysicalTable of the ENTITY MIB.

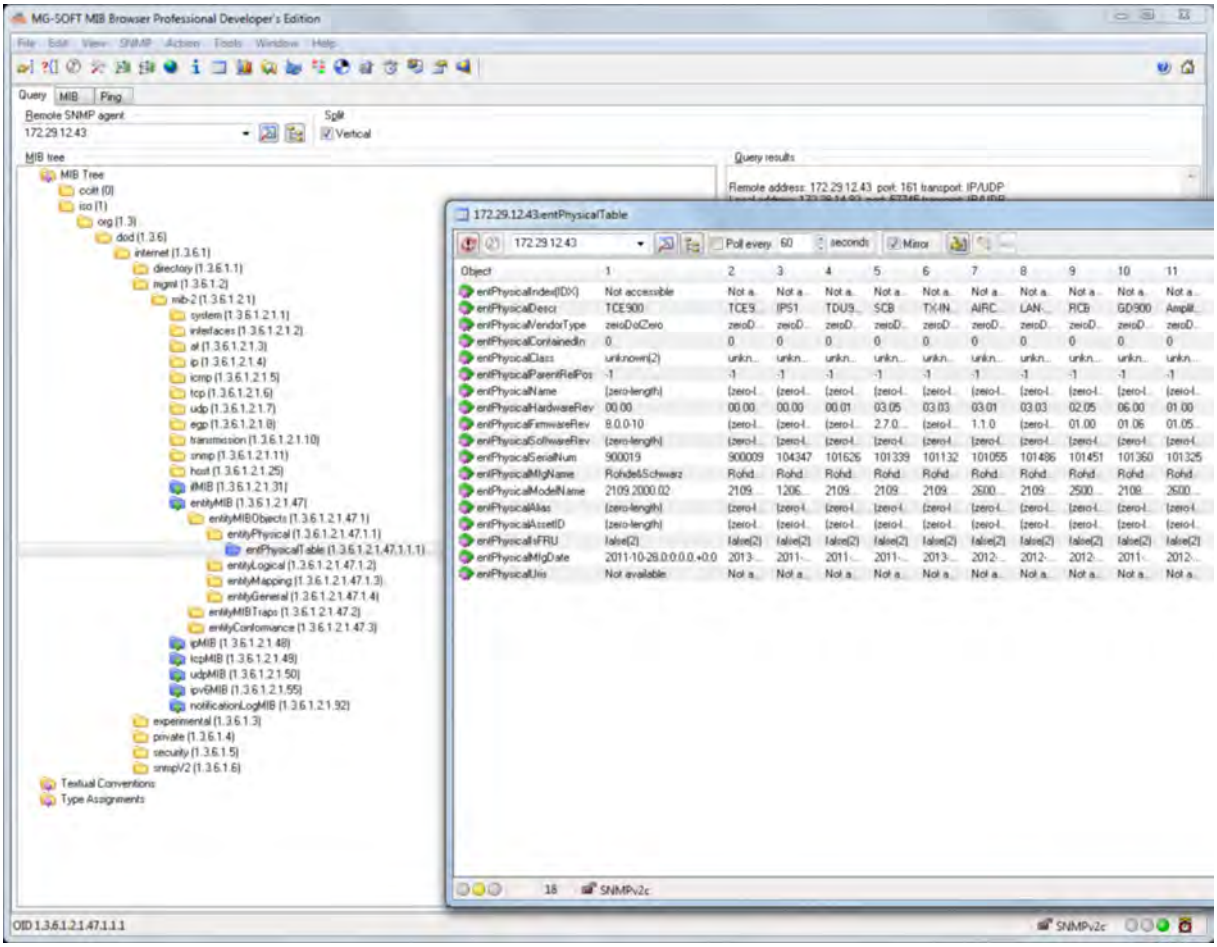


Fig. 5-7: entPhysical display (excerpt)

The extension of the entPhysicalTable in RS-XX9-COMMON-MIB (commonEntPhysicalTable):

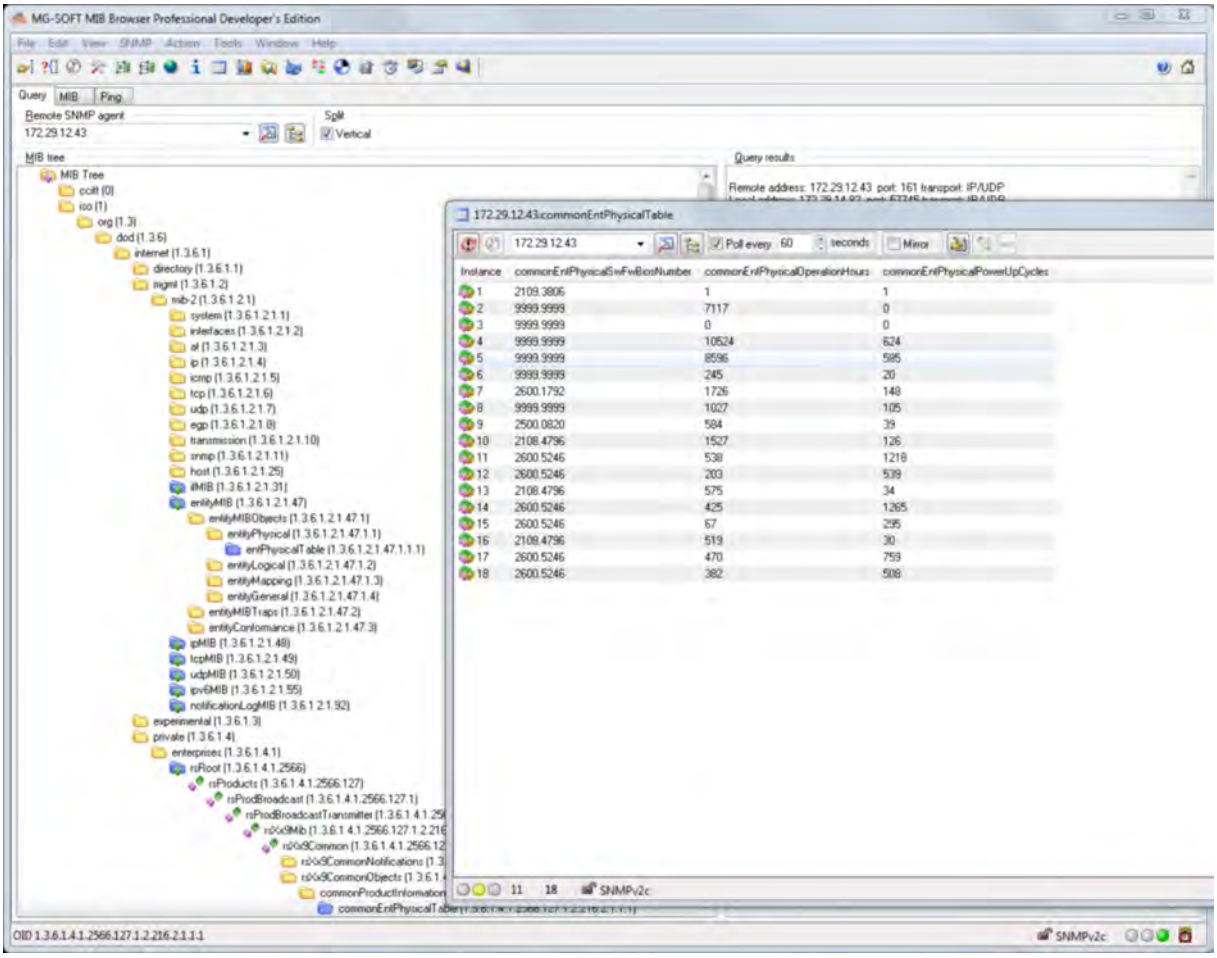


Fig. 5-8: commonEntPhysical display

5.4 Maintain Software

5.4.1 Software Update

The software of the R&S®TCE900 can be updated. Installing a new version will make new features available and will improve the functionality of the transmitter. New software versions are supplied as a file which can be run under MS Windows. Apart from the instrument software, this file also contains the "R&S Software Distributor" tool which allows the software to be installed on several R&S®TCE900 units at the same time. The software supports all R&S®TCE900 modules within a transmitter system.

The R&S®TCE900 must be prepared for the software update before installation is started. To ensure that a R&S®TCE900 is found in the network by the R&S Software Distributor, the software update must be started in the "Task View" > "Maintain SW" > "SW Update" menu of the respective R&S®TCE900. Alternatively, "Update Mode" can

be set to "Permanent" in this menu. This allows the software to be updated at any time without preparation.

The software update can then be performed on a Windows PC which is connected to the transmitter via the network.

- Deactivate the energy-saving option of the network card in the PC:
  - Under Windows, call the Device Manager by selecting *Start* > *Control Panel* > *System* > *Hardware* > *Device Manager*.
  - In the Device Manager, select the correct network adapter and double-click to call the associated Properties window.
  - In the Properties window, select the **Power Management** tab and (if necessary) deactivate the **Allow computer to turn off this device to save power** option.
- On the PC, start the installation software. The start window of the R&S Software Distributor appears.
- Confirm the default setting **Remote Installation** with *Next*.
  The installable software updates are displayed. To obtain additional information about an update, mark the update with the cursor and then click the *Info* button.
- Search for updatable devices in the network by clicking *Next*. After a few seconds a list of the found devices is displayed.
- If no devices are found even though the network settings are correct , the settings of the R&S Software Distributor must be checked under **Options** and corrected if necessary.
  - **Enable VISA** must be deactivated using the checkbox.
  - **Device Group** must match the device group displayed in the Software Update menu of the TCE.
  - Save the changed settings by clicking *Save Options* and then search again by clicking *Rescan*.
- In the Device List, select the device to be updated by marking the checkbox.
- Start the update by clicking Install.
- When the update is complete, a message is displayed in the info field at the bottom left of the window. The TCE900 is rebooted automatically.

If the update stops prematurely (i.e. the message "Copying/Installing ... %" stops before the 100 % mark is reached), abort the update by clicking Cancel and then restart the R&S Software Distributor.

"SW Update" parameters

- **Path:** *Task View (Home)* > *Maintain SW* > *SW Update*

Name	Description	Value range	Access right
Update Status (Software Update)	Indicates whether the R&S®TCE900 is ready for the device software update. ● Stopped: The R&S®TCE900 cannot be found in the network by the Software Distributor. It is not possible to update the software. ● Started: The R&S®TCE900 is listed in the update list of the R&S Software Distributor and the software can be updated.	Stopped, Started	Read only
Update Mode (Software Update)	Indicates how the software of the TCE can be updated. ● Manual: The R&S®TCE900 can be found by the Software Distributor for approx. 90 seconds after the "Start Update" button is pressed. ● Permanent: The R&S®TCE900 can be found by the Software Distributor at any time. The software can be updated at any time without the R&S®TCE900 needing to be prepared for a software update. The setting can be changed here.	Manual, Permanent	Maintenance
SW Version (Software Update)	Shows the software version currently installed on the TCE. The first number of the displayed SW version must be identical on all R&S®TCE900 units of a system to ensure that the system operates correctly.	-	Read only
Device Name (Software Update)	Shows the device name under which this R&S®TCE900 appears in the list of the Software Distributor. The setting can be changed here.	Up to 20 characters	Maintenance
Start Update (Software Update)	Starts the enable phase of a software update if "Update Mode" is set to "Manual". The enable phase is active for approx. 90 seconds. During this time, the R&S®TCE900 can be found in the network by the Software Distributor.	-	Maintenance
Device Group (Software Update)	Shows the device group. The displayed device group must be the same as the device group set in the Software Distributor so that this R&S®TCE900 is displayed in the list of devices found by the Software Distributor.	DEFAULT	Read only
Reboot (Software Maintenance)	Reboots the R&S®TCE900.	-	Maintenance

5.4.2 Backup/Restore

This function is used to make a complete backup of the currently installed software version as well as all settings of the R&S®TCE900. This backup is created in the file system of the R&S®TCE900 and can then either be downloaded to an external storage medium or restored at a later time.

Backups of the same R&S®TCE900 and also of other R&S®TCE900 units can be uploaded from an external storage medium and then restored.

If a backup is made before the software of the R&S®TCE900 is updated, it is then possible to revert to the old software version after the software has been updated by restoring the old version from the backup.

In order to download a backup to an external storage medium or to upload a backup from an external storage medium, there must be a direct network connection between the R&S®TCE900 and a PC. This function is not available for R&S®TCE900 units which can be reached only indirectly via a TCE900 SysCtrl.

"Backup/Restore" parameters

- **Path:** *Task View (Home) > Maintain SW > Backup/Restore*

Name	Description	Value range	Access right
Backup State (Backup/Restore)	Indicates the action which has just been performed. ● Ready The backup/restore functions can be started. ● Backup in Progress A backup has been started and will then be stored in the internal file system of the R&S®TCE900. ● Check in Progress The backup uploaded to the R&S®TCE900 is being checked. ● Restore in Progress The backup stored in the internal file system is being restored on the R&S®TCE900. ● Download in Progress The backup stored in the R&S®TCE900 is being copied to an external storage medium. ● Upload in Progress A backup is being copied from an external storage medium to the TCE900.	Ready, Backup/ Check/Restore/ Download/ Upload in Pro-gress	Read only
Start Backup (Backup/Restore)	Starts the creation of a backup. The backup is stored in the internal file system of the R&S®TCE900 and contains the current program version as well as all setting values of the R&S®TCE900. **The creation of a backup causes the R&S®TCE900 to reboot.**	-	Maintenance
Start Restore (Backup/Restore)	Restores the program version as well as all settings of the R&S®TCE900 from the backup which was stored in the file system of the R&S®TCE900.**Restoring a backup causes the TCE to reboot.**	-	Maintenance
Download File (Backup/Restore)	Copies the backup stored in the file system of the R&S®TCE900 to an external storage medium. This function is only available if the R&S®TCE900 is operated via a web browser.	-	Maintenance
Upload File (Backup/Restore)	Copies a backup from an external storage medium to the R&S®TCE900. This function is only available in the case of operation via a web browser.	-	Maintenance

Name	Description	Value range	Access right
File State (File Info)	Indicates the status of the backup stored on the R&S®TCE900. ● Available Backup OK The backup is OK. ● No Backup Available No backup has yet been made on or uploaded to the R&S®TCE900. ● Invalid Backup The backup is faulty. The backup cannot be used. ● Invalid Device The backup was not made on a R&S®TCE900. It is not compatible with this device. None of the files from this backup can be restored on this R&S®TCE900. ● Invalid Checksum The check routine performed on the backup returned a checksum error. The backup cannot be used in this case. ● Not Compatible The backup loaded from an external storage medium is not compatible with the R&S®TCE900. The backup cannot be used in this case. ● Invalid Software Version To be able to operate, the R&S®TCE900 requires a more recent software version than that contained in the backup.	-	Read only
Tx Name (File Info)	Shows the name of the transmitter from which the backup originates.	-	Read only
Name (File Info)	Shows the name of the device from which the backup originates. If the device name is not **TCE900**, the backup cannot be restored. The **Invalid Device** fault is displayed in this case.	-	Read only
Part Number (File Info)	Shows the part number of the R&S®TCE900 from which the backup originates. The backup can only be restored if the displayed part number is identical to the part number of the R&S®TCE900. The **Not Compatible** fault will otherwise be displayed.	-	Read only
Date Time (File Info)	Indicates when the backup was made.	-	Read only
Serial Number (File Info)	Shows the serial number of the instrument from which the backup was made.	-	Read only
SW Version (File Info)	Shows the software version which the backup contains.	-	Read only

5.5 Options

Under "Options" it is possible to activate additional features on a transmitter. The features requested when a transmitter was ordered are activated at the factory before the transmitter is delivered. Additional features can be purchased at any time from your local Rohde & Schwarz sales partner.

Options are stored on a SIM card inside the R&S®TCE900 and are always valid for the R&S®TCE900 in which the SIM card is installed. Options can be transferred to another R&S®TCE900 by swapping the SIM card.

The *Task View (Home)* > *Options* > *Status* menu provides an overview of the available or installed options.

In addition to permanent options, there are also temporary options. These options deactivate automatically after a certain period of time. The period of validity of temporary options is shown in the *Task View (Home)* > *Options* > *Details* menu.

Features are enabled by installing a valid activation key in the *Task View (Home)* > *Options* > *Manage Keys* menu.

"Manage Keys" parameters

- **Path:** *Task View (Home)* > *Options* > *Manage Keys*

Name	Description	Value range	Access right
Option Key (Install/Deinstall)	Used to enter an activation key.	30 characters	Maintenance
Message (Install/ Deinstall)	• Please enter a key Prompt to enter a key. • Key OK The key has been entered successfully (the display changes back to "Please enter a key" after a few moments). • Invalid format The entered key was invalid.	Please enter a key, Key OK, Invalid format	Read only

6 Operating the Device Manager

Using the Device Manager, the device type plates of all TCE900 units and the type plates of the modules they contain can be polled.

The type plates contain information about the current software version of programmable modules and all necessary information for spare parts procurement.

The Device Manager is started using the "Device Manager" button on the system, transmitter or exciter level.

6.1 Basic Settings

The structure of the transmitter system is configured in the "Basic Setup" menu. Each R&S TCE900 is assigned its logical function together with the other R&S TCE900 units, the physical installation position of the individual R&S TCE900 units is set and the distribution of transmitters and R&S TCE900 units in the racks is described.

The basic settings are made for each R&S TCE900 in the system and must be entered in the specified sequence:

- Hardware equipment ("Boards" menu tab)
  The hardware modules which each R&S TCE900 contains and at which position these modules are inserted in the R&S TCE900 base unit must be configured for each R&S TCE900.
- Definition of the logical function
  The task that each R&S TCE900 is to fulfill in the system must be defined.
- Integration of the R&S TCE900 in the transmitter system
  Depending on their function, some R&S TCE900 units require additional information regarding:
  – system variant (MultiTX, N+1)
  – transmitter variant (Redundancy, Modulation, Amplifier Type)
  – assignment to a transmitter (TX Number, Exciter A/B)
- Physical structure of the transmitter system
  Depending on their function, some R&S TCE900 units require additional information regarding:
  – total number of transmitter racks
  – number of racks per transmitter
- Physical installation location of the R&S TCE900 units
  Each R&S TCE900 must be assigned the following:
  – number of the rack in which the R&S TCE900 is installed
  – number of the installation slot within a rack
- Assignment of transmitters to racks ("Racks" menu tab)
  Each R&S TCE900 with the "Rack Control" function must be assigned those transmitters which are installed in the racks that the "Rack Control" function monitors.

Changes to the basic settings only become effective when the R&S TCE900 has been restarted.

In the tables below, "?" means that it must be taken into consideration whether an air cooling interface (ACIF) or a TX interface is installed. See the detailed description of the "Cooling Control" and "Rack Control" parameters in the table "**Description of setting values**".

Assignment of logical functions

Table 6-1: "Functions" for SingleTX systems (for TMU9 and TMV9 only)

Transmitter type	System Control	TX Control	Exciter	Cooling Control	Rack Control
Single drive					
Exciter	X	X	X	?	?
Backup drive					
Exciter A	X	X	X	?	?
Exciter B	-	X	X	-	-
Dual drive					
System Control	X	-	-	?	?
Exciter A	-	X	X	-	-
Exciter B	-	X	X	-	-

Table 6-2: "Functions" for MultiTX systems (<n> = 1 to 8)

Transmitter type	System Control	TX Control	Exciter	Cooling Control	Rack Control
Single drive					
System Control	X	-	-	?	X
Exciter (TX <n>)	-	X	X	-	-
Dual drive					
System Control	X	-	-	?	X
Exciter A (TX <n>)	-	X	X	-	-
Exciter B (TX <n>)	-	X	X	-	-

Table 6-3: "Functions" for N+1 systems (<n> = 1 to 8; TXB: <n> = 9)

Transmitter type	System Control	TX Control	Exciter	Cooling Control	Rack Control
Single drive					
System Control	X	-	-	?	X
Exciter (TX A<n>, TX B)	-	X	X	-	-

Transmitter type	System Control	TX Control	Exciter	Cooling Control	Rack Control
Rack Control (where applicable)	-	-	-	-	X
Dual drive					
System Control	X	-	-	?	X
Exciter A (TX A<n>, TX B)	-	X	X	-	-
Exciter B (TX A<n>, TX B)	-	X	X	-	-
Rack Control (where applicable)	-	-	-	-	X

Table 6-4: "Setup" for SingleTX systems (for TMU9 and TMV9 only)

Transmitter type	System Variant	TX Number	Exciter	Redundancy	No. of Transmitters
Single drive					
Exciter	SingleTX/MultiTX	A1	A	Single drive	1
Backup drive					
Exciter A	SingleTX/MultiTX	A1	A	Backup drive	1
Exciter B	-	A1	B	Backup drive	1
Dual drive					
System Control	SingleTX/MultiTX	-	-	-	1
Exciter A	-	A1	A	Dual drive	-
Exciter B	-	A1	B	Dual drive	-

Table 6-5: "Setup" for MultiTX systems (<n> = 1 to 8)

Transmitter type	System Variant	TX Number	Exciter	Redundancy	No. of Transmitters
Single drive					
System Control	SingleTX/MultiTX	-	-	-	<n>
Exciter (TX <n>)	-	A<n>	A	Single drive	-
Dual drive					
System Control	SingleTX/MultiTX	-	-	-	<n>
Exciter A (TX <n>)	-	A<n>	A	Dual drive	-
Exciter B (TX <n>)	-	A<n>	B	Dual drive	-

Table 6-6: "Setup" for N+1 systems (<n> = 1 to 8; TXB <n> = 9)

Transmitter type	System Variant	TX Number	Exciter	Redundancy	No. of Transmit-ters
Single drive					
System Control	N+1 TX	-	-	<n>	
Exciter (TX A<n>, TX B)	-	A<n>	A	Single drive	-
Rack Control (where appli-cable)	-	-	-	-	
Dual drive					
System Control	N+1 TX	-	-	-	<n>
Exciter A (TX A<n>, TX B)	-	A<n>	A	Dual drive	-
Exciter B (TX A<n>, TX B)	-	A<n>	B	Dual drive	-
Rack Control (where appli-cable)	-	-	-	-	-

Table 6-7: IP addresses for SingleTX systems (for TMU9 and TMV9 only)

Transmitter type	Ethernet Local
Single drive	
Exciter	192.168.58.100
Backup drive	
Exciter A	192.168.58.11
Exciter B	192.168.58.12
Dual drive	
System Control	192.168.58.100
Exciter A	192.168.58.11
Exciter B	192.168.58.12

Table 6-8: IP addresses for MultiTX systems (<n> = 1 to 8)

Transmitter type	Ethernet Local
Single drive	
System Control	192.168.58.100
Exciter (TX <n>)	192.168.58.<n>1
Dual drive	
System Control	192.168.58.100
Exciter A (TX <n>)	192.168.58.<n>1
Exciter B (TX <n>)	192.168.58.<n>2

Table 6-9: IP addresses for N+1 systems (<n> = 1 to 8; TXB <n> = 9; <m> = 2 to 9, No. of Rack Controls)

Transmitter type	Ethernet Local
Single drive	
System Control	192.168.58.100
Exciter (TX A<n>, TX B)	192.168.58.<n>1
Rack Control (where applicable)	192.168.58.10<m>
Dual drive	
System Control	192.168.58.100
Exciter A (TX A<n>, TX B)	192.168.58.<n>1
Exciter B (TX A<n>, TX B)	192.168.58.<n>2
Rack Control (where applicable)	192.168.58.10<m>

Table 6-10: Description of setting values

Name	Description	Value range	Access right
System Control	Set this check mark if this cassette of the R&S TCE900 is to function as a system control unit. In this case, all remote control interfaces and (if present) a R&S TDU900 display unit must be connected to this R&S TCE900. This R&S TCE900 can also perform the function of the N+1 automatic system. In addition to functioning as a system control unit, other functions can also be assigned to the same R&S TCE900 depending on the modules it contains.	Disabled, Enabled	Configuration
TX Control	Set this check mark if this cassette of the R&S TCE900 cassette is to function as a transmitter control unit. The transmitter control unit contains, for example, the function for monitoring the output power and an automatic exciter switchover function (optional). In addition to functioning as a transmitter control unit, other functions can also be assigned to the same R&S TCE900 depending on the modules it contains. This function must always be activated together with the "Exciter" function on the same R&S TCE900.	Disabled, Enabled	Configuration
Exciter	Set this check mark if this R&S TCE900 cassette contains at least one coder board and one RF board. With a R&S TCE900 which is configured as an exciter, the "TX Control" function must be activated at the same time, unless the R&S TCE900 exciter is to be operated as a standalone instrument. In addition to functioning as an exciter, other functions can also be assigned to the same R&S TCE900 depending on the modules it contains.	Disabled, Enabled	Configuration
Cooling Control	Set this check mark if this R&S TCE900 cassette contains at least one cooling interface or one air cooling interface. In addition to functioning as a cooling control unit, other functions can also be assigned to the same R&S TCE900 depending on the modules it contains. The "Cooling Control" function must always be activated together with the "Rack Control" function on the same R&S TCE900.	Disabled, Enabled	Configuration

Name	Description	Value range	Access right
Rack Control	Set this check mark if this R&S TCE900 is to monitor rack components (e.g. overvoltage protection) or door contacts. A "TX Interface" module must be installed in the R&S TCE900. With most system configurations, the Rack Control function is together with the System Control function on the same R&S TCE900. The only exception are multirack N+1 systems in which more than one Rack Control are installed. With THx9, the "Rack Control" function must always be activated together with the "Cooling Control" function on the same R&S TCE900. With TMx9, the Rack Control function must be activated if an air cooling interface is installed in the R&S TCE900 and the "Cooling" function is activated.	Disabled, Enabled	Configuration
System Variant	Indicates whether the system is a SingleTX, MultiTX or N +1 system. The setting can be changed here if the "System Control" function is active.	Single/ MultiTX, n+1	Configuration
TX Number	Indicates the transmitter to which this R&S TCE900 is assigned. The setting can be changed here if the "TX Control" function is active.	TX A1 to TX A8 + TXB	Configuration
Exciter	Indicates whether this R&S TCE900 is to operate as exciter A or exciter B. The displayed value must correspond to the cabling of the two exciters at the exciter switch. Exciter A is shown in the case of single drive transmitters. The setting can be changed here if the "Exciter" function is active.	Exc A, Exc B	Configuration
ParIO	Indicates whether remote control has been activated by means of parallel contacts. ParIO 32/80 corresponds to a parallel remote control interface card with 32 inputs and 80 outputs. ParIO 9/12 corresponds to a parallel remote control interface card with 9 inputs and 12 outputs. Remote control can be connected to a R&S TCE900 with the System Control function. In the case of N+1 systems, it is also possible to connect remote control to a R&S TCE900 with the TX Control function, but certain restrictions will then apply. The setting can be changed here if the "System Control" or "TX Control" function is active.	Off, 32/80, 9/12	Configuration
Redundancy	Indicates which redundancy method is supported by this transmitter. ● Single Drive: The transmitter contains one exciter. ● Dual Drive: The transmitter contains two exciters. If the active exciter fails, an automatic switchover function switches the system over to the standby exciter. ● **Only available with some system variants:** Backup Drive: The transmitter contains two exciters. If the active exciter fails, an automatic switchover function switches the system over to the standby exciter. The setting can be changed here if the "TX Control" function is active.	Single Drive, Dual Drive, Backup Drive	Configuration

Name	Description	Value range	Access right
Transmitters	Indicates how many transmitters the system contains. The B transmitter of an N+1 system is not included here. The setting can be changed here if the "System Control" function is active.	1 to 8	Configuration
Modulation	Indicates the modulation mode of the exciter. An appropriate software option must additionally be installed for the displayed modulation mode. Either the modulation modes for TV/DAB or those for FM/FMHD are available. The setting can be changed here if the "TX Control" or "Exciter" function is active.	DVB-T2, DVB-T, ISDB-T, ATSC, ATV, DAB, FM, FMHD	Configuration
Rack Number	Indicates the rack in which the R&S TCE900 module is installed. The left-hand rack is assigned the number 1. The setting can be changed here if the "System Control", "TX Control" or "Exciter" function is active.	1 to 18	Configuration
Amplifier Mode	Indicates whether the amplifiers are to be operated in broadband or Doherty mode. To operate the amplifiers in Doherty mode, the frequency ranges of the amplifiers must be set to the transmit frequency. This display only applies to amplifier types which support Doherty mode. The setting can be changed here if the "TX Control" or "Exciter" function is active.	Broadband, Doherty	Configuration
Amplifiers	Indicates the total number of amplifiers per output stage of this transmitter. Whether the amplifiers are housed in one or more racks is irrelevant. Up to 24 amplifiers per output stage are supported (FM: up to 8 amplifiers). The setting can be changed here if the "TX Control" function is active.	1 to 24	Configuration
Amplifier Type	Indicates the amplifier type used in the transmitter. ● PHU901: High-power amplifier, UHF, liquid-cooled. ● PMU901: Medium-power amplifier, UHF, air-cooled with Doherty mode. ● PHU902: High-power amplifier, UHF, liquid-cooled with Doherty mode. ● PHV902: High-power amplifier, VHF, liquid-cooled with Doherty mode. ● PMV901: Medium-power amplifier, VHF, air-cooled with Doherty mode. The setting can be changed here if the "TX Control" or "Exciter" function is active.	PHU901, PMU901, PHU902, PHV902, PMV901, PHR901, PMR901	Configuration
Slot Number	Indicates the position at which the R&S TCE900 is installed in the respective rack. In the THU9, position 1 is the left-hand slot; in the TMU9, position 1 is the top slot. The setting can be changed here if the "System Control", "TX Control" or "Exciter" function is active.	1 to 12	Configuration

Name	Description	Value range	Access right
Racks/Rack Control	Indicates how many racks are monitored by this R&S TCE900. Transmitters with more than 12 amplifiers monitor 2 racks with one rack control. With all other transmitters, this value must be set to 1. The setting can be changed here if the "Rack Control" function is active.	1 or 2	Configuration
Cooling Type	Indicates the type of cooling system. The displayed value must be suitable for the amplifier type. Further settings are made in the "Home" > "Cooling" > "Task View" > "Setup Cooling" menu.	Liquid, Air	Configuration
Racks/ System	Indicates the total number of racks contained in the system. The setting can be changed here if the "System Control" function is active.	1 to 18	Configuration
Racks/TX	Indicates the number of racks that the transmitter consists of. This setting is only relevant for THU9 transmitters with more than 12 amplifiers. In all other cases, the value 1 must be set here. The setting can be changed here if the "TX Control" function is active.	1 to 4	Configuration
Number of Rack Controls	Indicates the total number of rack controls which are active in the system. The setting can be changed here if the "Rack Control" function is active.	1 to 9	Configuration
Int. RF Sensor	Indicates whether the internal RF test point of the amplifier is to be used for measuring the transmit power. The setting is only relevant for "Amplifier Type = PMU901". The value "On" should be set if the transmitter consists of exactly one amplifier and no CAN bus test point is installed in the transmitter. The setting can be changed here if the "Rack Control" function is active.	Off, On	Configuration
Configuration	Indicates whether the selected combination of settings is valid and nonconflicting. The setting can be changed here.	OK, not Valid	Read only
Reboot	Reboots this R&S TCE900. Changes to settings in this and the other menu tabs of the Basic Config menu only become effective after a reboot.		Configuration
IP Address (Local IP Settings)	Used to set the IP address of the R&S TCE900 for internal communications with other R&S TCE900 units in this system. When the system is supplied, the internal IP addresses begin with 192.168.58. The last group of digits differs according to the following rule: ● System Control: 100 ● TX Control + Exciter: 11/12 (= TXA1, Exciter A/B) to 81/82 (= TXA8, Exciter A/B); 91/92 (= TXB, Exciter A/B) ● Rack Control (second rack): 101 The setting can be changed here.		Configuration

Name	Description	Value range	Access right
IP Address (Remote IP Settings)	Used to set the IP address of the R&S TCE900 system control. The settings depend on the network infrastructure.		
Slot Config	Used to determine which module is contained in each installation slot of the R&S TCE900 unit. Basically, any module can be inserted into any installation slot. The rack cabling has, however, been optimized for installation of the modules in the following slots: ● Slot A (bottom left): RF board or TX interface ● Slot B (top center): Cooling interface (CIF or ACIF) or ATV interface ● Slot C (bottom center): Reserved for receiver module ● Slot CD (top right): Coder board or LAN switch The setting can be changed here.	Coder Board, RFBoard, TXIf, CoolingIf, LANSwitchIf, ATVIf, CIF, ACIF	Configuration

7 User Administration

The user administration facility is available in conjunction with browser-based operation. The settings that you enter in user administration are also valid for opening menus in local operation. You can use the user administration facility to perform the following tasks.

- Create new user profiles
- Change user profiles (users and access rights)
- Delete user profiles
- Close active sessions

The "Superuser" ID with the factory-set password 1234 gives you extensive user administration rights.

7.1 Creating New User Profiles

Proceed as follows to create a new user profile:

1. Log on as Superuser via the web interface.
   User name: Superuser
   Password: 1234
   The processing options and a list of existing users are displayed.
2. Select the `Add new user` option.
3. Enter a user name and password and the desired permissions for this user.
   The password must be at least 6 characters long.
4. Click "Add user" if the settings are correct.
   Click "Reset" if the settings are not correct, and enter the settings again.

7.2 Changing User Profiles (Users and Access Rights)

Proceed as follows to modify an existing user profile:

1. Log on as Superuser via the web interface.
   User name: Superuser
   Password: 1234
   The processing options and a list of existing users are displayed.
2. From the list of existing users, select the user to be modified from the **Select** column.
3. Select the `Change selected user` option.
4. Change the user's profile according to your requirements.

5. Click "Change user" if the settings are correct.
   Click "Reset" if the settings are not correct, and enter the settings again.

For the default users, you can change the passwords only; you cannot change access rights.

7.3 Deleting User Profiles

Proceed as follows to delete a user profile:

1. Log on as Superuser via the web interface.
   User name: Superuser
   Password: 1234
   The processing options and a list of existing users are displayed.
2. From the list of existing users, select the user to be deleted from the **Select** column.
3. Select the `Delete selected user` option.
4. The profile is removed from the user list.

7.4 Closing Active Sessions

To obtain information about existing sessions and end active sessions, follow this procedure.

1. Log on as Superuser via the web interface.
   User name: Superuser
   Password: 1234
   The processing options and a list of existing users are displayed.
2. Select the `Show session list` option.
   A list with information about the active sessions is displayed.
3. From the list of existing sessions, select the session to be closed from the **Select** column.
4. Select the `Delete selected session` option.
   The selected session is closed.
5. Select the `Option Show user list` option.
   The list of existing users is displayed again.