CHAPTER 4

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1 General Information

Transmitters are put into operation by means of the graphical interface of the NETCCU®.

1.1 Preparations

Before you can put a transmitter into operation it must first have been fully installed. Check the following list to ensure that all connections have been correctly made:

☞ Check whether all the modules delivered have been correctly installed and connected as necessary.

☞ Check whether the transmitter has been correctly connected to the AC supply. Please note:

- ❍ Connection in general
  - – Power feed, rack ground, air cooling system, 50 Ω test load (dummy antenna) in appropriate cases, power-handling capacity P > nominal transmitter power, directional-coupler filter, matrix or antenna
- ❍ Connections involving RF carrier loops and fault messages
  - – Set up the following jumpers/connections on the power distribution board connectors (the name of the connector concerned is printed on the board).

    RF carrier loop, operation - **X41** 1-2 RF carrier loop, standby - **X41** 3-4 Fault message for rack absorber - **X42** 1-2 Fault message for system absorber - **X42** 3-4 (In the case of multirack transmitters, the overtemperature switches of the RF absorbers are connected to the absorber fault message inputs.)Fault message for external cooling - **X44** 1-2

    If customer instruments having interlock circuit outputs such as control monitoring are present, you can loop in these instruments in place of the wire jumpers.
- ❍ Emergency-off switch **X7** (if available)
- ❍ Motor protection switches to be set at 3 A

☞ Check the direction of the rotary field from the AC supply voltage.

☞ Switch off the main disconnect switch **Q1**, together with all motor protection switches and automatic line fuses.

☞ Check that all screws and nuts are securely fastened, especially those on the transmitter RF output.

1.2 Preconditions

1. Before switching on the transmitter, check whether the exciter is set to the correct frequency (consistent with any diplexer or bandpass filter that may be connected).

   If the transmission frequency is not yet known, the transmitter should remain switched off unti the frequency is set.

2. Connect an antenna to the RF output.

Switching on the transmitter

Switch on the transmitter as follows:

1. Turn the main disconnect switch on (**Q1**).
2. Switch on the exciter (**F1** or **F2**).

   The exciter should boot up.

3. Switch on the NETCCU® (**F3**).

   The NETCCU® should boot.

4. Switch on the auxiliary power supply (**F5**).
5. Switch on the fan fuse for fan 1 (**F6**) and fan 2 (**F7**).
6. If necessary switch on additional (**F4**) and peripheral units (**F8**).

1.3 Operating the NETCCU

Note *Detailed information on operating the NETCCU® can be found in the "Operation" section.*

2 Preparing to Put a Transmitter into Operation

Local operation of the NETCCU® includes all the main information calls for the most important system parameters and their settings, complete with intuitive graphical menus.

Remote operation via a web browser is possible only if a PC or notebook is connected to the NETCCU® front panel.

2.1 Preparing for Local Operation

To prepare for local operation proceed as follows:

☞ Press the **LOCAL** key on the NetCCU.

The corresponding yellow LED should come on.

2.2 Checking and Setting System and Operating Parameters

In order to bring the transmitter into operation, you must check and set the following system and operating parameters.

2.3 NETCCU

2.3.1 Switching on the NETCCU

☞ Connect the NETCCU® to the mains supply.

After a few seconds, the unit boots and the input screen indicates when it is ready for use.

Local operation of the NETCCU® includes all the main information calls for the most important system parameters and their settings, complete with intuitive graphical menus.

Remote operation via a web browser is possible only if a PC or notebook is connected to the NETCCU® front panel.

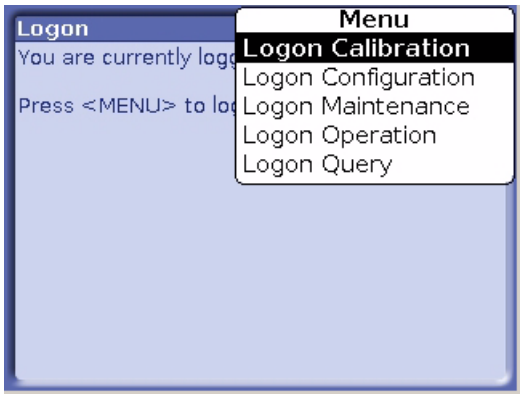
2.3.2 Changing the User Type

To configure the transmitter by means of the NETCCU® you must have configuration rights.

To log on proceed as follows:

1. From the menu, select the **Change User** menu point.

   The **Logon** window opens, displaying the currently valid user type.



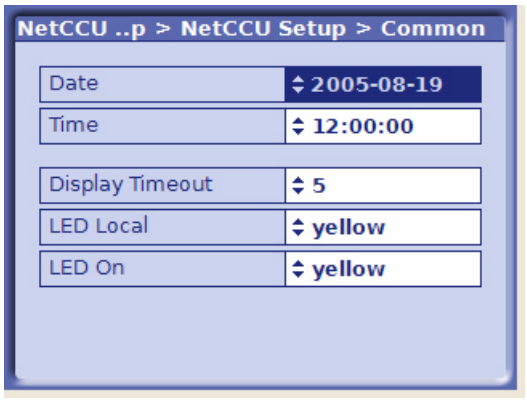
2. Call the context menu again and select user type **Configuration**.

2.3.3 Carrying out Basic Settings

After switching on the NETCCU®, you can enter the basic system settings.

☞ Select **NetCCU** > **Setup** > **NetCCU Setup > Common**.

The **Common** window opens.



You can enter the following settings in the **Common** window:

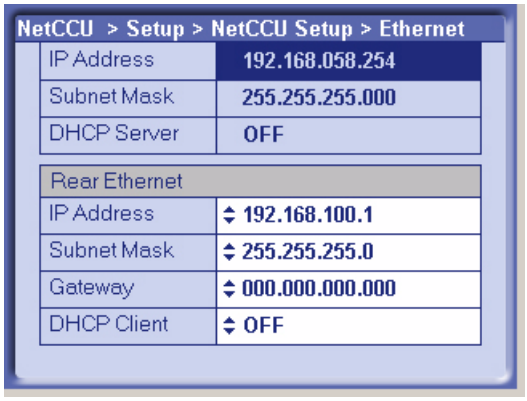
Selection	Description
Date	Date
Time	Local time
Display Timeout	Time in minutes after which the display switches off (standby)
LED Local	Color of the Local LED on the front panel of the NETCCU (yellow, green)

Selection	Description
LED On	Color of the On LED on the front panel of the NETCCU (yellow, green)

2.3.4 Entering Default Values for the Front Ethernet Connection

☞ Select **NetCCU** > **Setup** > **NetCCU Setup** > **Ethernet**.

The **Ethernet** window opens.



You can enter the following settings in the **Ethernet** window:

Selection	Description
Front Ethernet	
IP Address	The IP address (192.168.58.254) of the NETCCU is factory-set and cannot be changed. To make an external connection to a PC/Laptop the appropriate address must be entered: The first three segments (of the above IP address) stay the same, but a value < 250 must be entered for the last block of numbers.
Subnet mask	The setting for the NETCCU subnet mask is factory-set and cannot be changed. For an external connection, this same setting must also be entered on a PC or laptop.
DHCP Server	This function is not implemented in this version.
Rear Ethernet	Manual settings should only be entered in Offline mode (context menu: Edit Offline) and should then be activated by means of Submit Changes (context menu).
IP Address	Entry of a valid IP address. The IP address 192.168.058.254 is not to be used.
Subnet mask	The setting for the NETCCU subnet mask is factory-set, but can be changed if necessary. For an external connection, this setting must be defined in the network.
Gateway	Entry of a gateway address (assigned by the network administrator).

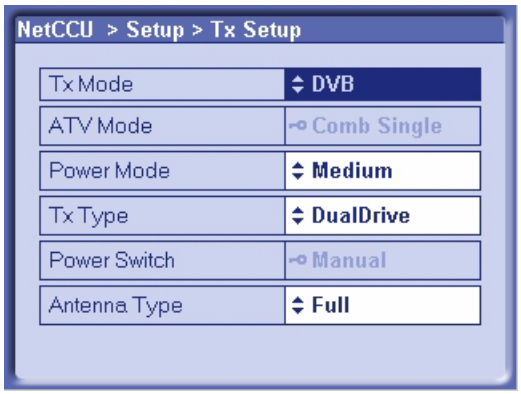
Selection	Description
DHCP Client	ON: The IP address is automatically retrieved from the net. OFF: The IP address has to be entered manually (see above).

Note *The system must be restarted in order to implement the changes.*

2.4 Setting the Transmitter Type

☞ Select **NetCCU** > **Setup** > **TX Setup**.

The **Tx Setup** window opens.



You can use the **TX Setup** window to make system-specific settings and to define standby behavior.

The table below describes the adjustable parameters:

Setting item	Description
TX Mode	Selection of the transmitter standard – FM: analog sound broadcasting standard – ATV: analoger TV standard – DVB: digital TV standard
ATV Mode	Selected only when setting ATV under TX Mode – Comb Single: picture signal and sound signal are transmitted via one amplifier (same channel) (single = 1 sound carrier) – Comb Dual: picture signal and sound signal are transmitted via one amplifier (same channel) (dual = 2 sound carriers)
Power Mode	Setting for medium-power transmitters – Medium
TX Type	For setting the standby behaviour: – Single TX: standby system (see below) – Dual Drive: standby system (see below)

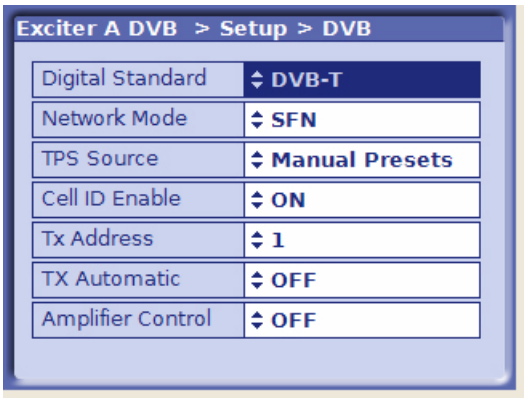
Setting item	Description
Power Switch	Setting of the hardware configuration for antenna switchover. The following options are available: – "Manual" for switching over the antenna manually – "Automatic" for switching over the antenna electronically
Antenna Type	Country-specific setting for the antenna type; the default setting is Full

2.5 Entering Exciter Settings

2.5.1 Setting the TV Standard

1. Select **Exciter A DVB** > **Setup > DVB**.

   The **Setup > DVB** window opens.



2. Select the wanted TV standard.

The table below describes the parameters in detail:

Setting item	Description
Digital Standard	Selection of the digital TV standard: DVB-T, DVB-H or ATSC *Switching over from DVB-T or DVB-H after ATSC is followed by a restart. At the same time signal processing is switched over and the associated user interface is loaded.*
Network Mode	Selection of the network operating mode: SFN or MFN
TPS Source	Setting the source for the TPS parameters: MIP or manual presets (see section "DVB Parameters > TPS") *The TPS source can also be set in the DVB Parameters > TPS menu window.*

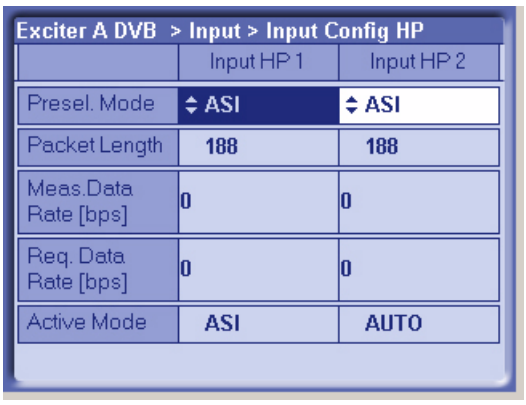
Setting item	Description
Cell ID Enable	Switching cell ID signaling on or off in the TPS The cell ID itself is set in the DVB Parameters > TPS menu window. It can also be retrieved from the MIP.
Tx Address	Setting the transmitter address; address range: 0 to 65535 Setting the transmitter is a precondition to reading Tx information (transmitter-specific settings) from the MIP. However, the information is only used if Tx Automatic is enabled.
Tx Automatic	Activates and deactivates the Tx Automatic When the automatics are enabled (and the transmitter address is set) the following Tx parameters are retrieved from the MIP: Time Offset, Frequency Offset and Cell ID
Amplifier Control	Activates and deactivates the amplifier control unit *In R&S low-power transmitters wothout NETCCU the exciter can take over amplifier control. This function is implemented with effect from software release V1.2.0.*

2.5.2 Configuring Input Interfaces

2.5.2.1 Specifying the Data Format for Data Streams HP 1 or HP 2

1. Select **Exciter A DVB** > **Input** > **Input Config HP**.

   The **Input** > **Input Config HP** window opens.



2. Go to **Presel. Mode** and select the value **Auto** for **Input HP 1** and **Input HP 2**.

   The data format is recognized automatically.

The table below describes the parameters in detail:

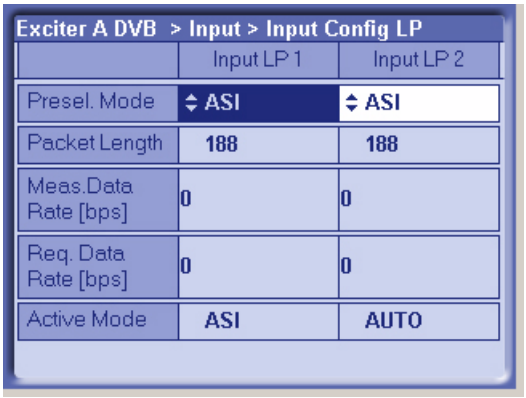
Setting item	Description
Presel. Mode [Input HP1/Input HP2]	Setting the data format for the data streams HP 1 or HP 2 (operating and standby signals) on inputs TS 1 IN or TS 3 IN. The options are as follows: – AUTO: The data format is automatically recognized – ASI: Manual setting for an ASI transport stream – SMPTE: Manual setting for a SMPTE transport stream *In the case of hierarchical coding the operating or standby signal for the high priority (HP) stream is fed via the two inputs HP 1 and/or HP 2.*

Display	Description
Packet Length [Input HP1/Input HP2]	Display showing the packet length detected at the respective input
Meas.Data Rate [bps] [Input HP1/Input HP2]	Display showing the *measured data rate* at the respective input. In MFN mode the net data rate is displayed (without null packets).
Req. Data Rate [bps] [Input HP1/Input HP2]	Display for checking the measured data rate. Depending on the chosen network mode, the following information is displayed: – MFN: *Maximum data processing rate* – SFN: *Required data rate*
Active Mode	Display showing the data format detected or set at the respective input: – ASI: As described – SMTPE: As described – Auto: Auto is selected and there is no data stream

2.5.2.2 Specifying the Data Format for Low Priority Data Streams LP 1 or LP 2

1. Select **Exciter A DVB** > **Input** > **Input Config LP**.

   The **Input** > **Input Config LP** window opens.



2. Go to **Presel. Mode** and select the value **Auto** for **Input LP 1** and **Input LP 2**.

   The data format is recognized automatically.

The table below describes the parameters in detail:

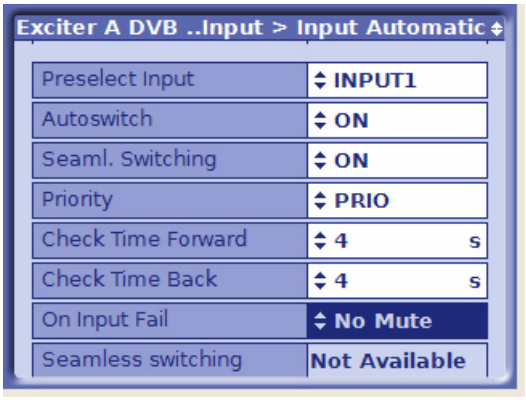
Setting item	Description
Presel. Mode [Input LP1/Input LP2]	In the case of hierarchical coding: Setting the data format for the low priority data streams LP 1 or LP 2 (operating and standby signals) on inputs TS 2 IN or TS 4 IN. The options are as follows: – AUTO: The data format is automatically recognized – ASI: Manual setting for an ASI transport stream – SMPTE: Manual setting for a SMPTE transport stream

Display	Description
Packet Length [Input LP1/Input LP2]	Display showing the packet length detected at the respective input
Meas.Data Rate [bps] [Input LP1/Input LP2]	Display showing the *measured data rate* at the respective input. In MFN mode the net data rate is displayed (without null packets).
Req. Data Rate [bps] [Input LP1/Input LP2]	Display for checking the measured data rate. Depending on the chosen network mode, the following information is displayed: – MFN: *Maximum data processing rate* – SFN: *Required data rate*
Active Mode	Display showing the data format detected or set at the respective input: – ASI: As described – SMTPE: As described – Auto: Auto is selected and there is no data stream

2.5.2.3 Setting Automatic Input Switchover

1. Select **Exciter A DVB** > **Input** > **Input Automatic**.

   The **Input** > **Input Automatic** window opens.



2. Activate automatic input switchover if required, and enter the appropriate settings.

The table below describes the parameters in detail:

Setting item	Description
Preselect Input	For preselecting the inputs – INPUT 1: The operating input is TS 1 IN. In the case of hierarchical coding, TS 2 IN is used as a second operating input for the low priority stream. – INPUT 2: The operating input is TS 3 IN. In the case of hierarchical coding, TS 4 IN is used as a second operating input for the low priority stream.
Autoswitch	Switches the *automatic input switchover* on or off. In the event of a failure on the active operating input, automatic switchover to the standby input takes place. The automatic switchover mode is defined by the following parameter settings.
Seaml. Switching	Switches seamless input switchover on or off. – ON: In the event of a failure, input switchover takes place without a break in transmission, provided the data streams are synchronized at the operating and standby inputs. – OFF: For the purpose of testing the automatic input switchover, the Seaml. Switching function can be deactivated. *The function has no effect when automatic input switchover is deactivated.*
Priority	Selection of the *priority mode*. – EQUAL: The preselected operating input and standby input have the same priority. Once a switchover has taken place there is normally no return switchover to the operating input which previously failed. – PRIOR: The preselected operating input is the priority input. Once a switchover has taken place the system switches back to the preselected operating input as soon as the signal reappears.
Check Time Forward	For setting a delay time (0 to 60 s) which must elapse before the switchover to the standby input takes place in the event of a failure on the operating input.

Setting item	Description
Check Time Back	For setting a delay time (0 to 60 s) which must elapse before switching back to the operating input after switching over from the standby input (which is no longer active). *The function has no effect if the priority mode is set to EQUAL.*
On Input Fail	For setting the behavior in the event of a defective input signal (synchronization error) – No Mute: The output signal is not suppressed – Mute: The output signal is suppressed if the data rate is incorrect or the MIP is faulty (recommended for SFN)

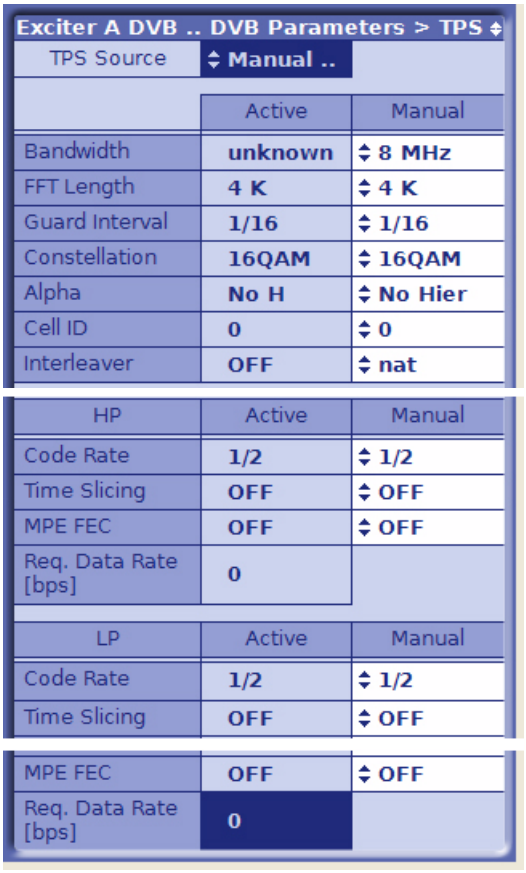
Display	Description
Seamless Switching	Status display for indicating whether the input streams are synchronized on the operating and standby inputs (precondition for seamless input switchover).

2.5.3 Entering Settings for Signal Encoding

2.5.3.1 Selecting the TPS Source

1. Select **Exciter A DVB** > **DVB Parameters** > **TPS**.

   The **DVB Parameters** > **TPS** window opens.



2. Select the **Manual Presets** setting for **TPS Source** if you wish to configure the TPS parameters manually

   or

   the **MIP** setting if you prefer the TPS parameters to be retrieved from the MIP.

2.5.3.2 Setting the TPS Parameters Manually

Note *You can only configure the TPS parameters manually if the **Manual Presets** setting is selected for **TPS Source**.*

1. Select **Exciter A DVB** > **DVB Parameters** > **TPS**.

   The **DVB Parameters** > **TPS** window opens.

2. Set the TPS parameters.

The table below describes the variable parameters in detail:

Setting item	Description
TPS Source	Setting the source for the TPS parameters: MIP or manual presets

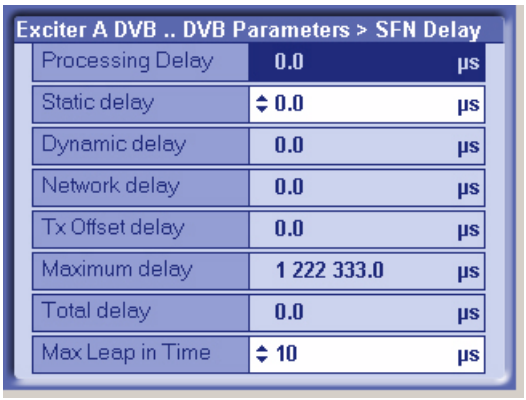
Display/ setting item	Description of the active or manually set TPS parameters
Bandwidth	Signal bandwidth Display/setting: 5, 6, 7 or 8 MHz
FFT Length	IFFT length Display/setting: 2k or 8k; also 4k in the case of DVB-H
Guard Interval	Guard interval Display/setting: 1/4, 1/8, 1/16 or 1/32
Constellation	Modulation mode Display/setting: QPSK, 16QAM or 64QAM *In the case of hierarchical coding* the value refers to the sum of the HP and LP stream constellation points; possible values are therefore: 16QAM or 64QAM
Alpha	*Hierarchy parameter* α Display/setting: – No Hier: Non-hierarchical coding – 1 H: Hierarchical coding with α = 1 – 2 H: Hierarchical coding with α = 2 – 3 H: Hierarchical coding with α = 3 1 H, 2 H or 3 H activates the hierarchical coding mode. However, this is only possible if Constellation is set to 16QAM or 64QAM.
Cell ID	Cell ID Display/setting: 0x0000 to 0xFFFF The Cell ID can only be retrieved from the MIP if the Tx Automatic is activated and the Tx address is correctly set (see section "Setup > DVB"). For the purpose of signaling in the output signal (TPS), Parameter Cell ID Enable must also be activated (see section "Setup > DVB").
Interleaver	Interleaver Display/setting: – nat: Default setting ("native") with normal function for DVB-T – in depth: 8k interleaving for DVB-H at IFFT lengths of 2k and 4k for improved transmission reliability (*DVB-H parameter*)
Code Rate [HP/LP]	Internal code rate (separate for HP and LP stream) Display/setting: 1/2, 2/3, 3/4, 5/6 or 6/7
Time Slicing [HP/LP]	Time slicing flag (*DVB-H parameter*) Display/setting separate for HP and LP stream: – OFF: Default setting; no signaling via flag – ON: A flag is set in the broadcast DVB signal. This flag informs the receiver that at least one service in the DVB-H data stream uses time slicing.

Display/ setting item	Description of the active or manually set TPS parameters
MPE FEC [HP/LP]	MPE FEC flag (*DVB-H parameter*) Display/setting separate for HP and LP stream: – OFF: Default setting; no signaling via flag – ON: This flag informs the receiver that at least one service in the DVB-H data stream uses forward error correction for MPE (multiprotocol encapsulation).
Req. Data Rate [HP/LP]	Display showing the required data rate: cf. section "Input > Input Config HP"

2.5.3.3 Checking Delays at SFN Delay - SFN Mode Only

1. Select **Exciter A DVB** > **DVB Parameters** > **SFN Delay**.

   The **DVB Parameters** > **TPS** > **SFN Delay** window opens.



2. If necessary, enter a **static delay** and check whether the **dynamic delay** is in the range **0** to **1** second (if not the single-frequency condition is violated).

The table below describes the variable parameters in detail:

Display	Description
Maximum Delay	Period of time between the signal leaving the play-out center (MIP inserter) and its regular transmission at the transmitting antenna. This delay is set in the MIP inserter and serves as a basis for all the transmitters in the SFN.
Network Delay	Signal propagation time between the play-out center (MIP inserter) and the exciter input. This delay depends on the transmission path used.
Processing Delay	Minimum signal transit time through the exciter. This delay depends on the DVB transmission parameters.
Dynamic Delay	Period of time by which signal processing is artificially delayed so that the desired time of transmission is obtained.

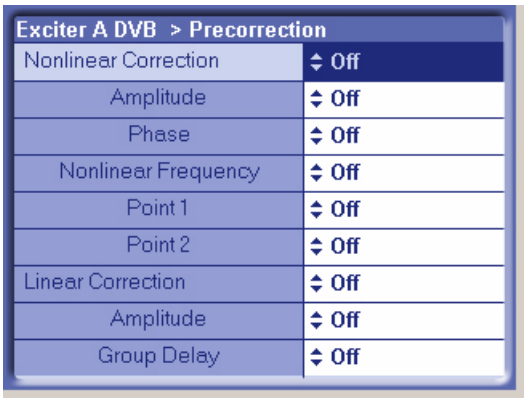
Display	Description
Total Delay	Actual signal transit time through the exciter. This is derived from the sum of the processing delay and the dynamic delay.
Tx Offset Delay	The offset in time of transmission (positive or negative) sent to the MIP for the individual transmitter site, relative to the regular time of transmission specified by the maximum delay. For the purpose of display and activation, the Tx Automatic must be enabled and the Tx address of the transmitter must agree (see section "Setup > DVB"). *If Tx offset delay and static delay are both present at the same time, their effects combine.*

Setting item	Description
Static Delay	The offset in time of transmission (positive or negative) set manually for the individual transmitter site, relative to the regular time of transmission specified by the maximum delay. The static delay can be used to compensate for manufacturing differences between transmitter systems. *If static delay and Tx offset delay are both present at the same time, their effect combines.*
Max Leap in Time	In relation to the computed time of transmission, this is the maximum leap in time that can be corrected without a break in transmission. Default setting: 10 µs

2.5.4 Switching Off the Precorrector

1. Select **Exciter A DVB** > **Precorrection**.

   The **Precorrection** window opens.



2. Switch all precorrectors off.

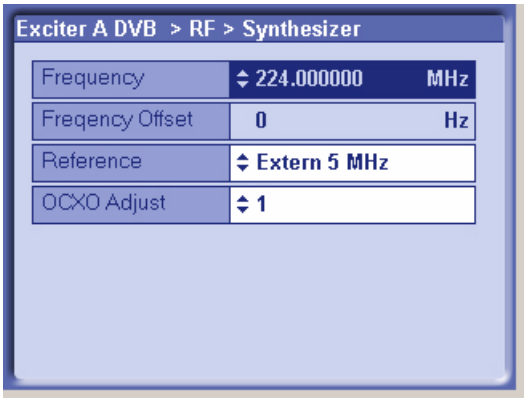
The table below describes the variable parameters in detail:

Setting item	Description
Nonlinear Correction	Switches the entire nonlinear correction on or off.
– Amplitude	Switches the amplitude correction in the nonlinear corrector on or off.
– Phase	Switches the phase correction in the nonlinear corrector on or off.
– Nonlinear Frequency	Switches the entire nonlinear frequency response correction on or off.
– Point 1	Switches the frequency response influence on branch 1 on or off (nonlinear frequency response correction).
– Point 2	Switches the frequency response influence on branch 2 on or off (nonlinear frequency response correction).
Linear Correction	Switches the entire linear correction on or off.
– Amplitude	Switches the amplitude frequency response correction in the linear corrector on or off.
– Group Delay	Switches the group delay correction in the linear corrector on or off.

2.5.5 Setting the Transmitter Frequency

1. Select **Exciter A DVB** > **RF** > **Synthesizer**.

   The **RF** > **Synthesizer** window opens.



2. Enter the desired settings.

The table below describes the variable parameters in detail:

Setting item	Description
Frequency	Setting the channel center frequency

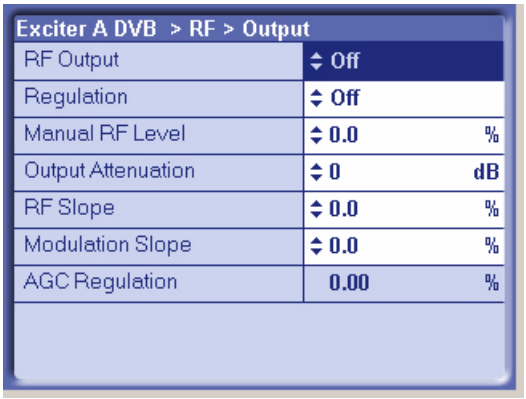
Setting item	Description
Reference	Selecting the reference source for stabilization of the frequency processing (*reference frequency source)*. The following settings are possible: – Internal: Operation without an external reference frequency source. – External 5 MHz: Operation with an external 5 MHz reference. – External 10 MHz: Operation with an external 10 MHz reference. – External 1pps: Operation with an external time reference (1 pps) *The same setting options can be found in the RF > Reference menu window.*
OCXO adjust	Setting for adjusting the internal OCXO frequency (for "Internal" mode). *The same setting options can be found in the RF > Reference menu window.*

Display	Description
Frequency offset	Any frequency offset is added straight to the channel center frequency. The frequency offset transferred in the MIP is addressed to a particular transmitter in the network and is evaluated only if the Tx address set in the Setup > DVB menu window is the correct recipient. For the purpose of display and activation the Tx Automatic also needs to be enabled (see section "Setup > DVB").

2.5.6 Setting RF Output

1. Select **Exciter A DVB** > **RF** > **Output**.

   The **RF** > **Output** window opens.



2. For normal transmission operation, enter the following settings:

Note *For **Output Attenuation** use the preselected value **0 dB**.*

Setting item	Setting
Regulation	ON
Output Attenuation	0 dB (for NW8201 - 9 dB)
RF Slope	0 %
Modulation Slope	0 %

The table below describes the variable parameters in detail:

Setting item	Description
RF Output	Enables (On) or disables (Off) the RF output.
Regulation	Activates (On) or activates (Off) the *output level control*. During transmission operation, control must be enabled. *The current status of the related level adjuster is displayed as a percentage under RF > RF Monitor > AGC Exciter.*
Manual RF Level	Manual setting of the *output level*; the setting has an effect only if output level control is deactivated. *The current status of the related level adjuster is displayed as a percentage under RF > RF Monitor > AGC Exciter.*
Output Attenuation	For level adaptation purposes, an integrated attenuator with a value of 3 dB, 6 dB or 9 dB can be connected. *This has no influence on the level control.*
RF Slope	Correction of a slope of the amplitude frequency response in the spectrum for equalizing subsequent components (output stage, filter).
Modulation Slope	Correction of a curvature of the amplitude frequency response in the spectrum for equalizing subsequent components (output stage, filter).

Display	Description
AGC Regulation	Displays the level of the output level control

2.5.7 I/Q adjustment

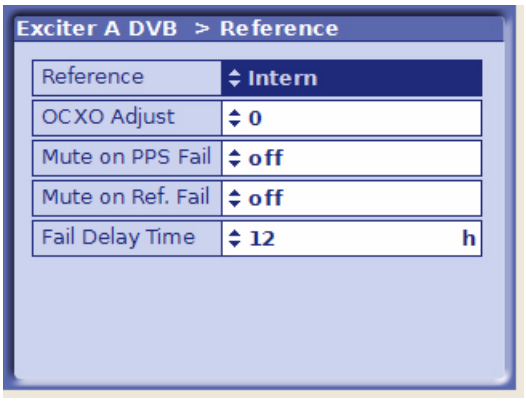
Note *When delivered, the I/Q modulator is factory-adjusted so that no customer intervention is normally required.*

*If a further I/Q adjustment is needed at a later time, the actuators in the **RF** > **IQ Adjust** menu window can be used for this purpose.*

2.5.8 Specifying Behavior on Failure of a Reference Source

1. Select **Exciter A DVB** > **Reference**.

   The **Reference** window opens.



2. Select the desired settings:

The table below describes the variable parameters in detail:

Setting item	Description
Reference	Selection of the reference frequency source. The following settings are possible: – Internal: Operation without an external reference frequency source. – External 5 MHz: Operation with an external 5 MHz reference. – External 10 MHz: Operation with an external 10 MHz reference. – External 1pps: Operation with an external time reference (1 pps) *The same setting options can be found in the RF > Synthesizer menu window.*
OCXO Adjust	Setting for adjusting the internal OCXO frequency (for "Internal" mode). *The same setting option can be found in the RF > Synthesizer menu window.*
Mute on PPS Fail	For setting the behavior in SFN mode in the event of failure of the external time reference. The following settings are possible: – off: The output signal is not suppressed. – only at startup: The output signal is suppressed at startup until a valid 1-pps signal is detected; if the 1-pps signal fails after synchronization, the output signal is no longer suppressed – after fail delay time: The output signal is suppressed if the 1-pps signal fails for longer than the period specified at Fail Delay Time This is the recommended setting for operation in SFN mode.

Setting item	Description
Mute on Ref. Fail	For setting the behavior in SFN and MFN mode in the event of failure of the external reference frequency source. The following settings are possible: – off: The output signal is not suppressed. – only at startup: The output signal is suppressed at startup until a valid reference source is detected; if the reference source fails after synchronization, the output signal is no longer suppressed – after fail delay time: The output signal is suppressed if the reference source fails for longer than the period specified at Fail Delay Time This is the recommended setting for operation in SFN mode.
Fail Delay Time	Delay time until the output signal is suppressed after failure of a reference source. The setting takes effect if the 'after fail delay time' behavior is set at Mute on PPS Fail or Mute on Ref. Fail. Selection: 0 to 24 hours

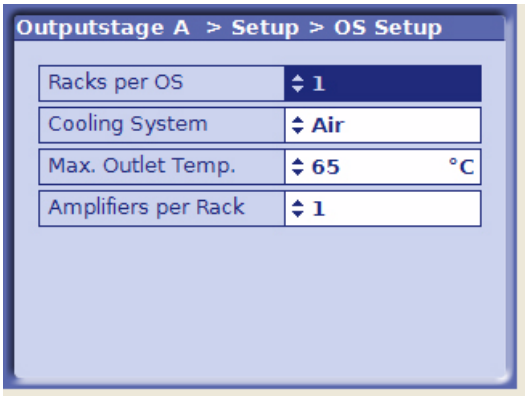
2.6 Entering Output Stage Settings

2.6.1 Preparing the Output Stage

You can enter the basic settings for the output stage in the **OS Setup** window.

☞ Select **Outputstage A** > **Setup** > **OS Setup**.

The **OS Setup** window opens.



The table below describes the variable parameters in detail:

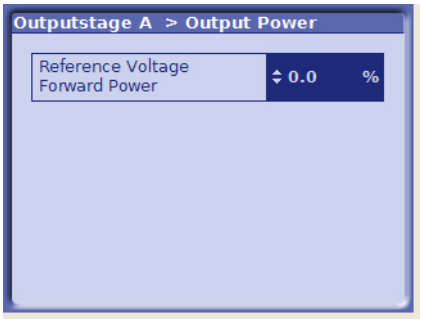
Setting	Description
Racks per OS	For entering the number of racks belonging to the transmitter

Setting	Description
Cooling System	For setting the cooling system used Value: Air
Max. Outlet Temp.	For inputting the maximum permitted outlet air temperature If the entered limit is exceeded the rack controller switches off the transmitter rack. Value: 45 °C - 65 °C
Amplifiers per Rack	For entering the number of amplifiers installed in the rack Value: 1 - 6

2.7 Setting the Transmitter Output Power

1. Connect a power meter to the free test point **P14C** on the forward power system AVG.
2. Select **Outputstage A** > **Output Power**.

   The **Output Power** window opens.



3. Keep changing the value at **Reference Voltage Forward Power** until the power meter reaches nominal power.

The following table specifies the coupling attenuation by transmitter type.

Transmitter type	Nominal power	Coupling attenuation at test point P14C
NW8201	0.325 kW	50 dB
NW8202	0.650 kW	53dB
NW8203	0.975 kW	55 dB
NW8204	1.300 kW	56 dB
NW8205	1.625 kW	56 dB
NW8206	1.950 kW	57 dB

2.8 Calibrating Power Displays

Note *The test points have been calibrated at the factory.*

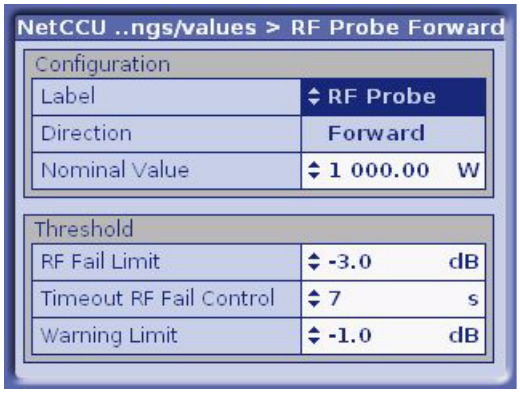
2.8.1 Calibrating Forward and Reflected Power Displays

Forward power display

Note *The transmitter must be operated at nominal power (set by means of a reference measurement).*

1. Select **NetCCU** > **RF settings/values** > **RF Probe Forward**.

   The **RF Probe Forward** window opens.



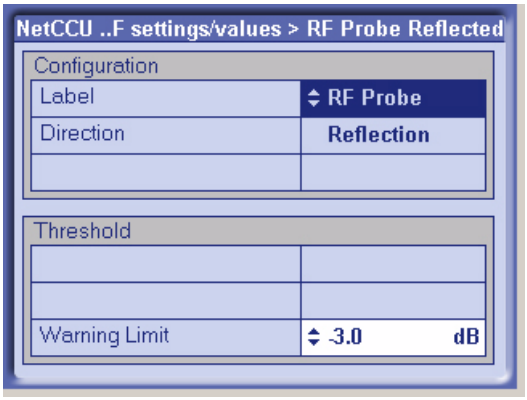
2. Use the **Set Gain** command to measure and save the DC voltage of the forward test point at nominal output power.
3. Switch off the transmitter.
4. Use the **Set Offset** command to measure and save the DC voltage of the forward test point at 0 W output power.

Reflected power display

Note *The transmitter must be operated at nominal power (set by means of a reference measurement).*

1. Select **NetCCU** > **RF settings/values** > **RF Probe Reflected**.

   The **RF Probe Reflected** window opens.



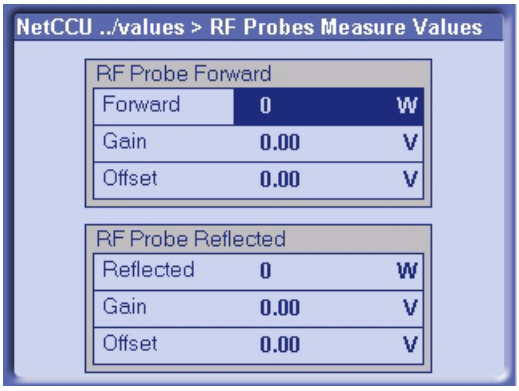
2. Use the **Set Gain** command to measure and save the DC voltage of the forward test point at nominal output power.
3. Switch off the transmitter.
4. Use the **Set Offset** command to measure and save the DC voltage of the forward test point at 0 W output power.

Checking

After calibrating the displays you can check the values for offset and gain in the **RF Probes Measured Values** window.

☞ Select **NetCCU** > **RF settings/values** > **RF Probes Measure Values**.

The **RF Probes Measure Values** window opens.



3 Completion of the Procedure for Putting the Transmitter into Operation

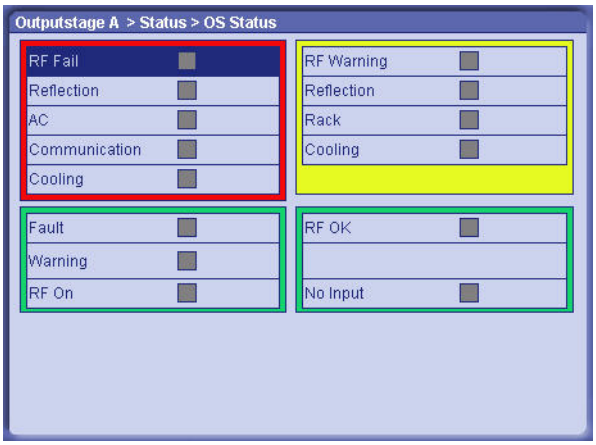
When the steps described in the above sections have been carried out the transmitter is ready to operate. Each transmitter receives a test report from the final testing department complete with measurement data on every quality parameter. This means that on site compliance testing is only necessary at the customer's request.

3.1 Final Steps

3.1.1 Checking the Output Stage Status Display

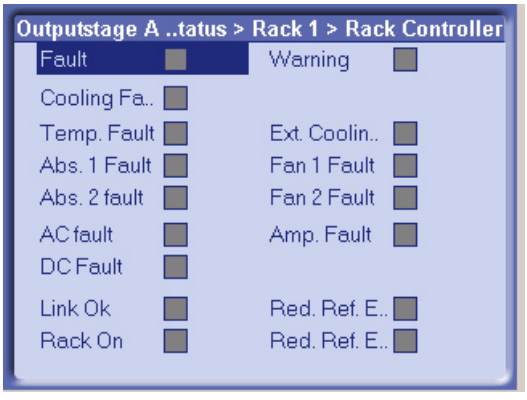
1. Select **Outputstage** > **Status** > **OS Status**.

   The **OS Status** window opens.



2. Check the status of the warning and error indicators. No warnings or errors are reported on a transmitter that is ready to operate.
3. Select **Outputstage** > **Status** > **Rack Status** > **Rack1** > **Rack Controller**.

   The **Rack Status** > **Rack1** > **Rack Controller** window opens.

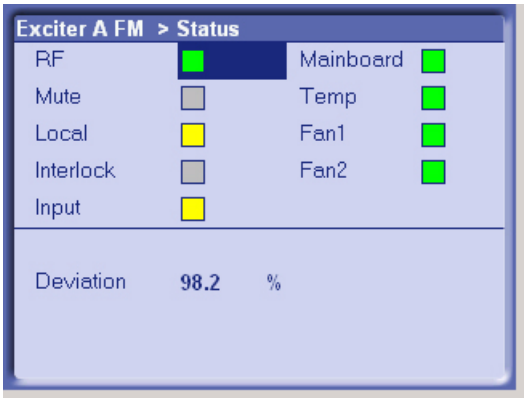


4. Check the status of the warning and error indicators. No warnings or errors are reported on a transmitter that is ready to operate.

3.1.2 Checking the Exciter Status Display

1. Select **Exciter A/B** > **Status**.

   The **Status** window opens.

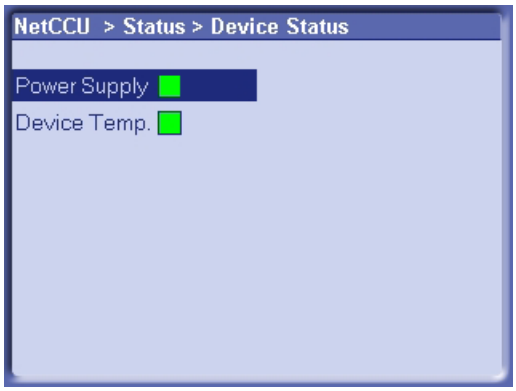


2. Check the status of the warning and error indicators. No warnings or errors are reported on a transmitter that is ready to operate.

3.1.3 Checking the NETCCU Status Display

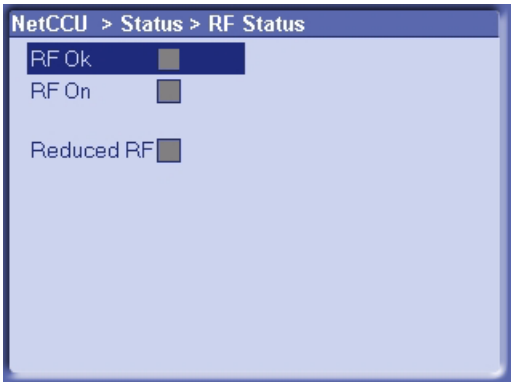
1. Select **NETCCU** > **Status** > **Device Status**.

   The **Device Status** window opens.



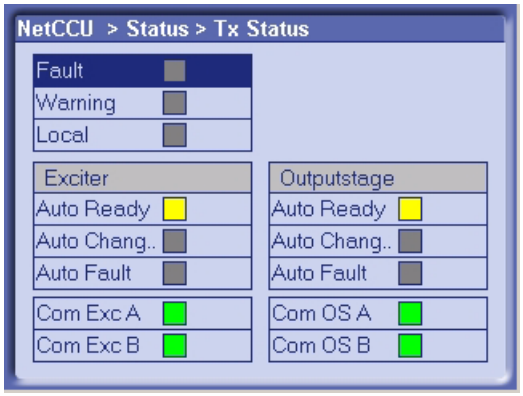
2. Check the status of the warning and error indicators. No warnings or errors are reported on a transmitter that is ready to operate.
3. Select **NETCCU** > **Status** > **RF Status**.

   The **RF Status** window opens.



4. Check the status of the warning and error indicators. No warnings or errors are reported on a transmitter that is ready to operate.
5. Select **NETCCU** > **Status** > **Tx Status**.

   The **Tx Status** window opens.



6. Check the status of the warning and error indicators. No warnings or errors are reported on a transmitter that is ready to operate.

3.2 Clearing the Event Memory

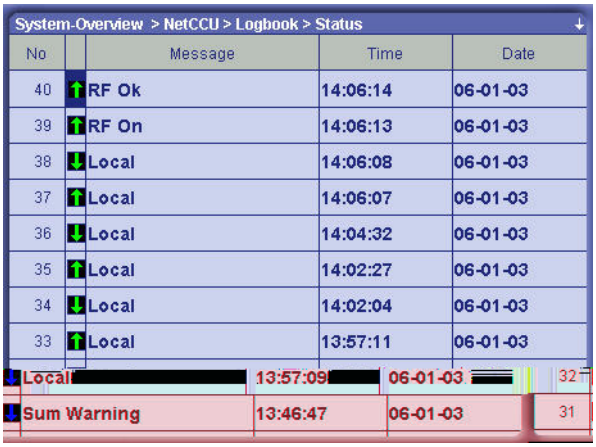
The modules NETCCU, Exciter and OS (output stage) have four event memories each.

- Summary
- Status
- Warning
- Fault

These event memories need to be cleared for all the modules before the transmitter assumes regular transmission.

1. Select **NETCCU** > **Logbook** > **Status**.

   The **Status** window opens.



2. From the context menu, select the **Clear Logbook** command.

   The entries are cleared.

3. Repeat the procedure for each of the event memories listed.

4 Precorrection

This section describes the non-linear precorrection sequence in manual mode.

4.1 Functions of the Non-Linear Precorrector

4.1.1 General

In the basic version, the graphical user interface of the non-linear precorrector for DTV and video signals consists of the **Nonlinear** control panel and the **FreqCorrection** control panel. In the case of ATV split, two further control panels are provided: **Dynamic Control** for the video precorrector and **Nonlinear Audio** for the audio signal. In combined mode an audio phase precorrector is also provided for audio.

4.1.2 Linear Basic Precorrection

The basic functions of the non-linear precorrector can be accessed via the **Nonlinear** and **Nonlinear Audio** control panels. Additional functions can be performed in the other control panels.

Every non-linear precorrector consists of an amplitude precorrector and a phase precorrector, each independently affecting the phase distortion and amplitude distortion of the same signal. The setting of the characteristic is displayed in a graphic in which the X axis represents the instantaneous signal amplitude. The figures 0% and 100% stand for no signal amplitude and maximum amplitude respectively. The Y axis represent the effect and is scaled to ±50 % for amplitude precorrection and ±45° for phase precorrection. 50% means that at 100% amplitude the level is increased by 3 dB.

Every precorrector has a series of frequency reference points which are used to model the characteristic. Frequency reference points can be user-defined, shifted in the X and Y directions, be given a fixed or free slope and be deleted. In the X direction a frequency reference point can only be shifted between the two adjacent reference points. The connections between frequency reference points are computed by means of spline functions.

Every characteristic consists of at least two points, one of which must be at 0% and the other at 100%.

In the case of amplitude precorrection the first point is at [0%, 0%] and cannot be shifted. The second point is at 100% and can be shifted without restriction in the Y direction. A rising or falling straight line between the two points represents only an amplification or attenuation of the signal and does not create non-linear products.

In the case of phase precorrection the first point is at 0% and the second point is at 100%. Both points can be shifted without restriction in the Y direction. A straight line parallel to the amplitude axis creates only a signal phase shift and does not create non-linear products.

4.1.3 Non-Linear Frequency Responses

As an additional function, the non-linear components of the DTV/video precorrection (amplitude or phase precorrection) can be assigned a frequency response in the FreqCorrection control panel, and the effect of the frequency response depends on the modulation.

If the amplitude precorrection or phase precorrection is affected by an amplitude frequency response, only the "individual" precorrection is affected. Amplitude precorrection and phase precorrection have no influence on one another.

If the amplitude precorrection or phase precorrection is affected by a phase frequency response, part of the "individual" precorrection affects the other precorrection. The amplitude precorrection and phase precorrection therefore have an influence on one another.

4.1.4 Dynamic Precorrection (ATV Split Only)

In ATV split systems, the large fluctuations in the average value of the video signal brings about temperature changes in the output-stage transistor which lead to changes in the output stage characteristic as a function of the average value of the modulation. This error can be compensated for by dynamically modifying the characteristic as a function of the average signal value.

4.1.5 Audio Phase Precorrection (ATV Combined Only)

In ATV combined systems, the common amplification of video and audio causes the audio signal to be affected by the video signal. This effect can be minimized with the aid of an audio phase precorrector.

4.2 General Information on Operating the Precorrector

The precorrector is operated by means of a web browser. The NETCCU® or the exciter provides a JAVA applet which is launched by the web browser. This applet contains all of the elements needed to operate the precorrector.

Note *Detailed information on operating the precorrector and configuring the graphical user interface can be found in the "Operation" section of the exciter manual.*

4.3 Performing Precorrection

The objective of precorrection is for the precorrector to simulate the non-linear characteristic of the amplifier as accurately as possible in order to increase the linearity of the output signal.

However, the precorrection limit is tied to the overload capacity of the output stage. To obtain the greatest possible efficiency and lowest possible costs for a given transmitter, the output stages are set so as to achieve a transmitter output signal of the required quality.

4.3.1 General Requirements

The following requirements should be fulfilled prior to precorrection:

- The transmitter must be operated at its nominal power output and the system level must be adjusted at all points.
- Precorrection must be on, for which the **Nonlinear** control panel must be selected in the precorrector graphical interface. A precorrection curve consisting of a straight line positioned on the X axis must be set for the amplitude precorrection and another for the phase precorrection.

4.3.2 Determining System Levels

The graphical area contains lines representing distinctive signal levels such as all-white level (Wht), all-black level (Blk) and sync pulse level (Sync), as well as sync pulse level (Sync/Aud) in the case of ATV combined. In DVT the level lines indicate the peak level (Peak) and the average value (Avh). These marks indicate maximum level; the actual level may be different.

Changes to the set curve that affect only the range above the system level have no effect on the signal or on precorrection of the signal.

The following method can be used to determine the actual values:

1. Use two interpolation points to determine the ends of the effective dynamic range in order to define the possible setting range of the precorrector:
   a) Add two interpolation points to the amplitude precorrection graph in the area above the highest mark and set their slope.

      You now have four points, consecutively numbered 1 to 4 from left to right. Points 2 and 3 are each indicated by an arrow.

   b) Shift points 3 and 4 in the positive Y direction by +50%. Point 3 should then be immediately adjacent to point 2.

   c) Use the **Write** button to write this curve to the precorrector.
2. Now use the Navigator window to reduce the position of interpolation points 2 and 3 together in steps of one percent. Observe the effect:

ATV Split	In ATV split systems, the first effect is seen in the sync pulse length, which can be clearly observed on the TV demodulator (sync pulse length display) or the TV analyzer.
ATV Combined	In ATV combined systems, the first effect is seen in the intermodulation products about the two sound carriers f_{Tx} ± default f(T2-T1)
DTV	In DTV systems the effect is seen as a reduced shoulder distance

   The upper of the two interpolation points thus represents the determined dynamic range limit.

3. Restore the original status.

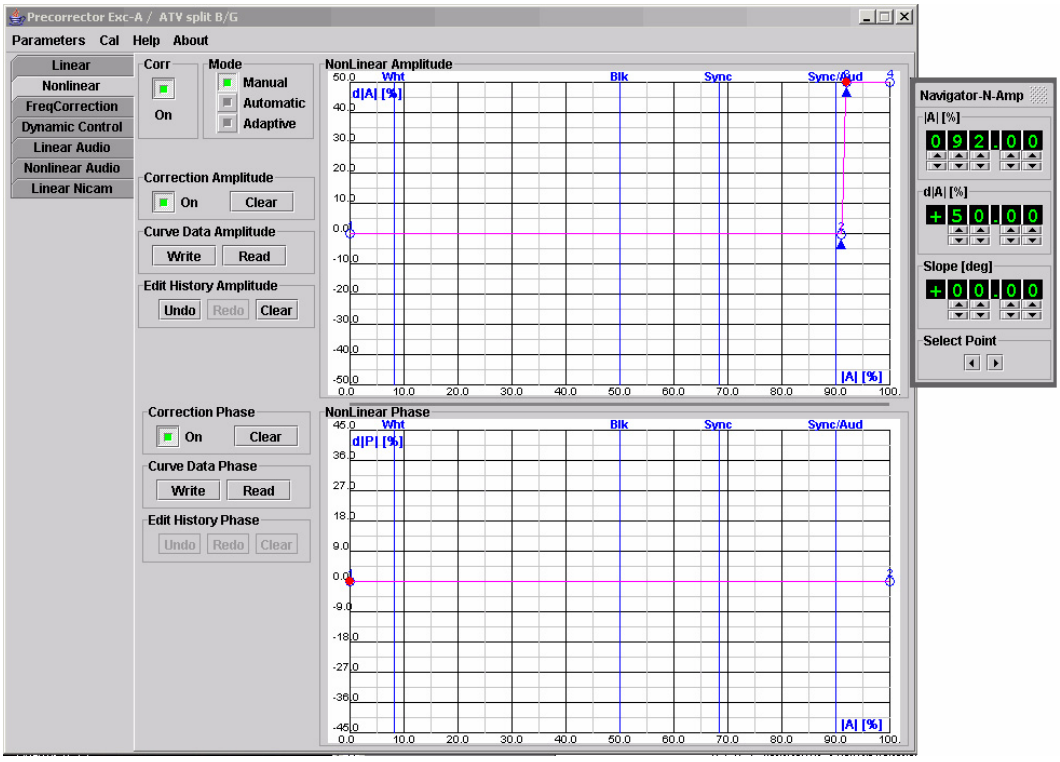


Fig. 1 *Determining system levels*

4.3.3 Precorrection Procedure

4.3.3.1 Starting Precorrection

Preconditions

The following requirements should be fulfilled prior to precorrection:

- ❍ The transmitter must be operated at its nominal power output and the system level must be adjusted at all points.
- ❍ A spectrum analyzer must be connected to the transmitter output.

Note *A test measurement should be carried out upstream of the output filter, since the shoulders are hard to detect due to band limiting by the filter. When measuring signals with the aid of the spectrum analyzer, it is important to ensure that the precorrection target, e.g. 38 dB shoulder distance, is well above the noise limit but the level of the spectrum analyzer is such that no intermodulation is generated in its input section.*

- ❍ Precorrection must be activated. The graphical area must contain two interpolation points each for the amplitude precorrection and the phase precorrection, the first at 0% level with magnitude 0% or 0° and the second at 100% level with magnitude 0% or 0°.

A DTV spectrum with clear shoulders should be visible on the analyzer.

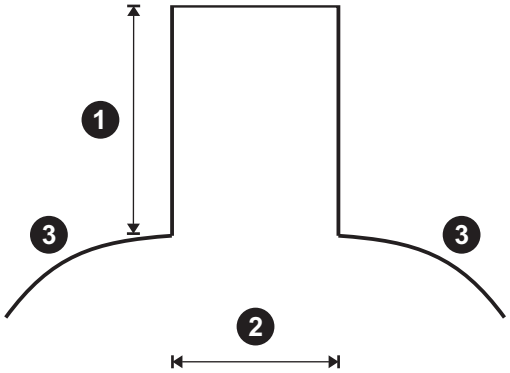


Fig. 2 *Spectrum of a DVB signal*

1) Shoulder distance
2) Useful signal
3) Shoulder

Start

1. Start precorrection with the phase precorrection.
2. Since phase precorrection and amplitude precorrection affect one another, repeat both precorrection procedures if necessary until the optimum result is obtained.

4.3.3.2 Phase Precorrection

Proceed as follows for phase precorrection:

1. Add in a phase reference point at about 10%.

   This position corresponds to a lower modulation of the amplifier.

2. Shift the magnitude of the interpolation point for 100% up or down in steps of 0.5 or smaller (+ or -) until the shoulder distance on the analyzer visibly improves.
3. Keep improving the shoulder distance on the analyzer until the optimum result is obtained.
4. Set another point at about 35%.
5. Shift the magnitude of the interpolation point for 10% up or down in steps of ±0.5 or smaller until the shoulder distance on the analyzer visibly improves.
6. Keep shifting the magnitudes of interpolation points 2 (10%), 3 (35%) and 4 (100%) in small steps until the optimum result is obtained.

Note *Further interpolation points can be added for an optimum precorrection. The recommended number is four to a maximum of six interpolation points (including the interpolation points at 0% and 100%).*

If phase precorrection gives no improvement or only a minor one, the phase precorrection must be canceled and amplitude precorrection must be carried out first.

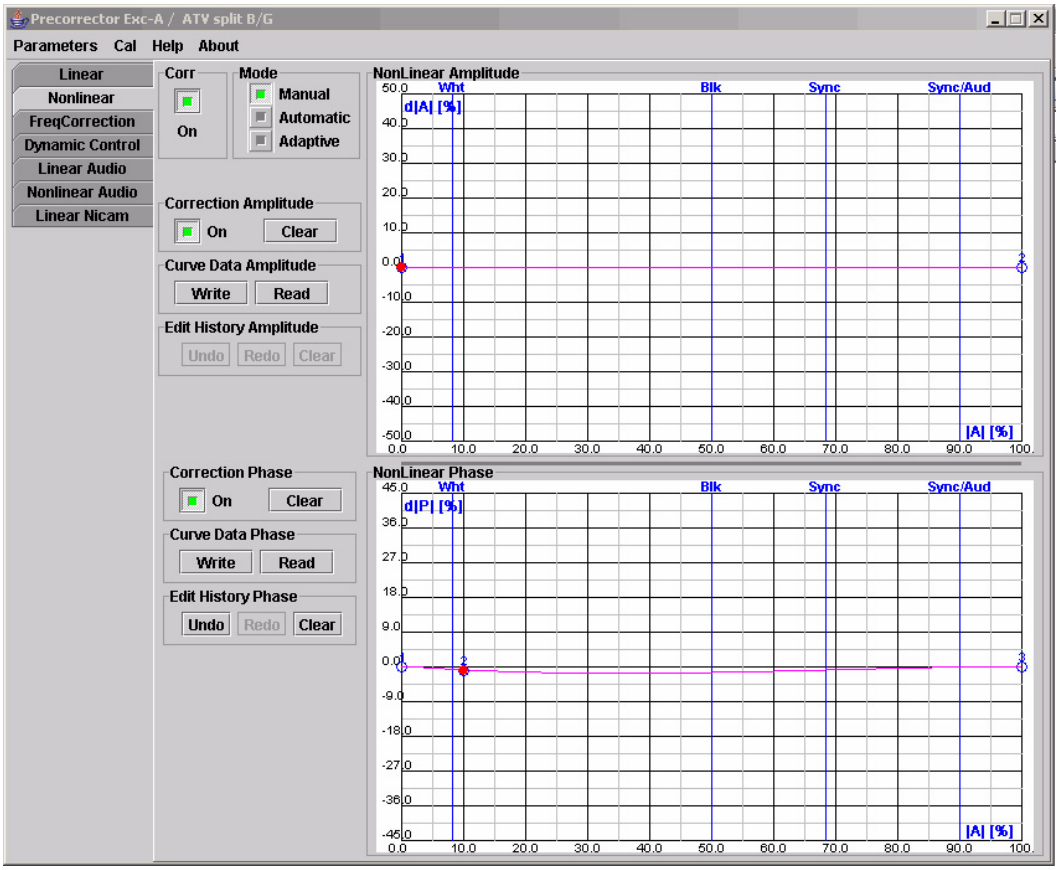


Fig. 3 *Typical curve for starting precorrection with amplitude precorrection switched off*

4.3.3.3 Amplitude Precorrection

The procedure for amplitude precorrection is the same as that for phase precorrection.

If the first interpolation point brings about an improvement, deal similarly with the other interpolation points.

1. Set the interpolation points more or less at the positions of the phase values.
2. Set all magnitudes to zero.
3. Starting with the interpolation point for the white level (low), change the magnitude (in steps of ± 0.5 or smaller) in order to find the precorrection.

Note *From here on it is a prerequisite that the precorrection for phase and amplitude has been optimized at all interpolation points.*

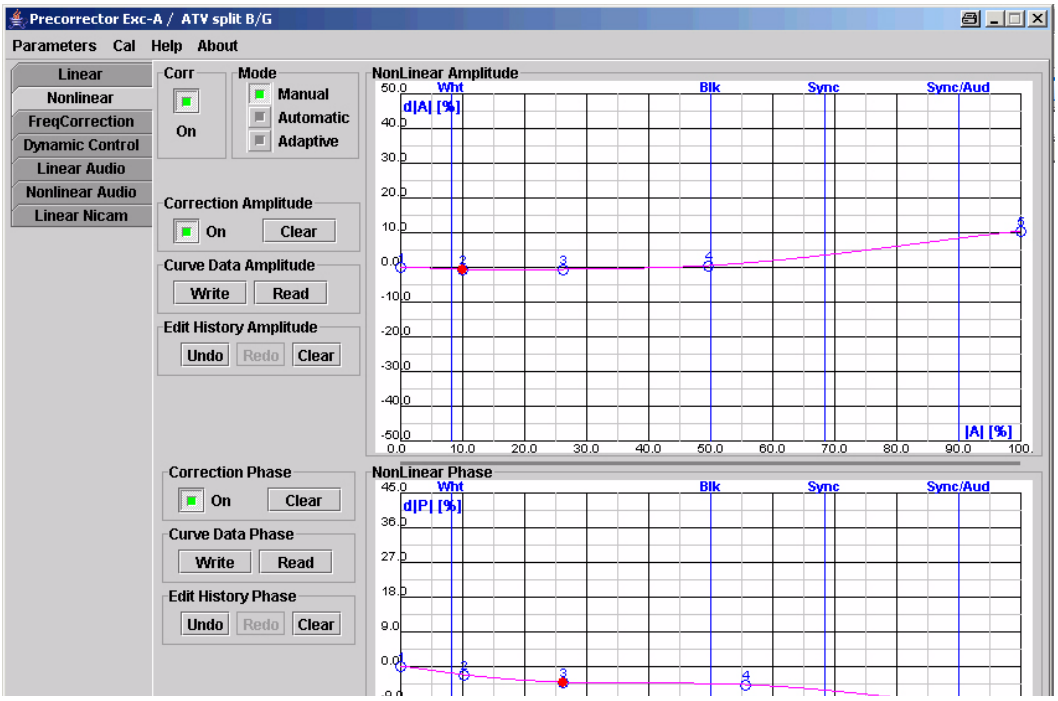


Fig. 4 *Typical curve with both phase and amplitude precorrection switched on*

4. Optimize the shoulder distance using all interpolation points again, in particular by shifting the interpolation point at 100%.

Keep carrying out phase precorrection and amplitude precorrection alternately until no further improvement can be obtained.

Note *Further interpolation points can be added for an optimum precorrection. The recommended number is four to a maximum of six interpolation points (including the interpolation points at 0% and 100%).*

4.3.3.4 Frequency Dependent Precorrection

Background

The **FreqCorrection** control panel can be used to influence the characteristic by means of an amplitude and/or phase frequency response, the effect of which is dependent on the level.

A set frequency response is applied to all signal components having a level greater than the selected threshold. On the other hand lesser signal components are unaffected.

An amplitude frequency response (**Amplitude Slope Amplitude 1/2** or **Amplitude Slope Phase 1/2**) and a phase frequency response (**Phase Slope Amplitude 1/2** or **Phase Slope Phase 1/2**) can be applied to the amplitude characteristic and the phase characteristic independently of one another. Two independent thresholds are available (**Position Point 1** or **Position Point 2**). The position of the thresholds (**1** or **2**) and their effect (**A** or **P**) are symbolically represented in the graphic.

Optimizing the shoulder distance

1. First use the the **Curve Data Amplitude Read** and **Curve Data Phase Read** buttons in the **Nonlinear** control panel to read off the characteristics currently set in the precorrector.

   The characteristics are displayed in the display part of the graphic.

2. Go to the **FreqCorrection** control panel.

   The characteristics can be seen in the graphic.

3. In the precorrector graphical user interface, switch **Correction** to **ON** and also activate **Correction Point 1**, **Amplitude Slope Point 1** and **Phase Slope Point 1**. Set **Position Point 1** to 5%.

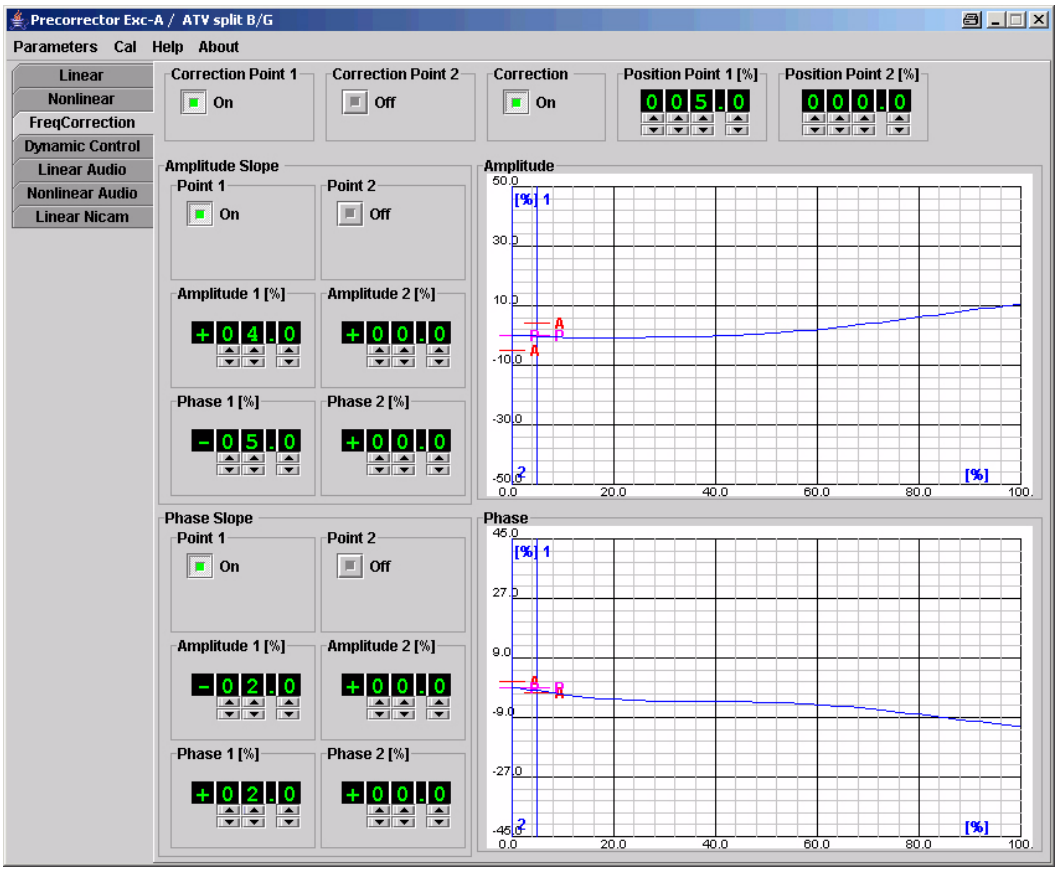


Fig. 5 *The FreqCorrection user interface with an onset point at 5%*

4. Now minimize the shoulder distance to left and right of the signal range by alternately setting the amplitude and phase regulators with the aid of the slopes of point 1.
5. Go back to the **Nonlinear** control panel.
6. If necessary optimize the characteristic.
7. Keep repeating steps 2, 3, 4 and 6 until the shoulder distance to left and right of the signal range reaches the required value between 37 dB and 40 dB.

If necessary you must to some extent suppress the frequency dependent non-linearity in the upper level range.

1. Set another onset point in the upper level range >25%.
2. Optimize the shoulder distance by alternately setting the amplitude and phase regulators with the aid of the slopes of point 2.

   The slopes will then point in the opposite direction than at Point 1.

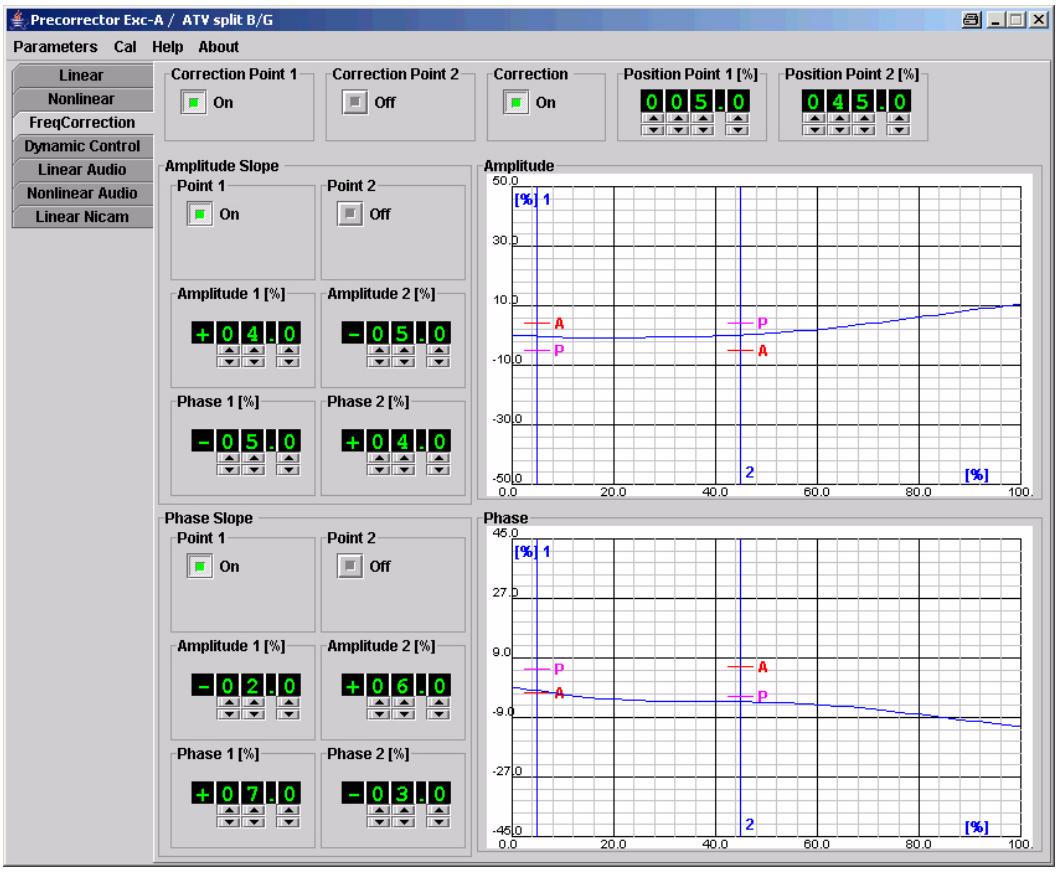


Fig. 6 *The FreqCorrection user interface with a second onset point*

4.3.3.5 Fine Adjustment Using an Existing or Preset Characteristic

If the required data is not or is no longer observed to be in an existing or factory-set precorrection characteristic, the precorrection does not necessarily have to be readjusted.

An adjustment to the true amplifier characteristic can be obtained by changing individual interpolation points. The range with the greatest effect can be determined by slightly changing individual interpolation points. Changing the interpolation values in this range will most probably produce the desired result. Changes should be made in small steps, preferably with the aid of the **Navigator** window. A change must be undone if it does not result in an improvement.