the t.racks

FIR DSP 408
digital speaker management system

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FIR DSP 408

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1 General information

This user manual contains important information on the safe operation of the device. Read and follow all safety notes and all instructions. Save this manual for future reference. Make sure that it is available to all persons using this device. If you sell the device to another user, be sure that they also receive this manual.

Our products and user manuals are subject to a process of continuous development. We therefore reserve the right to make changes without notice. Please refer to the latest version of the user manual which is ready for download under *www.thomann.de*.

1.1 Further information

On our website (*www.thomann.de)* you will find lots of further information and details on the following points:

Download	This manual is also available as PDF file for you to download.
Keyword search	Use the search function in the electronic version to find the topics of interest for you quickly.
Online guides	Our online guides provide detailed information on technical basics and terms.
Personal consultation	For personal consultation please contact our technical hotline.
Service	If you have any problems with the device the customer service will gladly assist you.

1.2 Notational conventions

This manual uses the following notational conventions:

Letterings

The letterings for connectors and controls are marked by square brackets and italics.
Examples: *[VOLUME]* control, *[Mono]* button.

Displays

Texts and values displayed on the device are marked by quotation marks and italics.
Examples: *'24ch'*, *'OFF'*.

Text input

Text inputs that are carried out on the device are indicated by typewriter font.

Example: 2323

Instructions

The individual steps of an instruction are numbered consecutively. The result of a step is indented and highlighted by an arrow.

Example:

1. ▶ Switch on the device.

2. ▶ Press *[Auto]*.

    ⇨ Automatic operation is started.

3. ▶ Switch off the device.

1.3 Symbols and signal words

In this section you will find an overview of the meaning of symbols and signal words that are used in this manual.

Signal word	Meaning
DANGER!	This combination of symbol and signal word indicates an immediate dangerous situation that will result in death or serious injury if it is not avoided.
NOTICE!	This combination of symbol and signal word indicates a possible dangerous situation that can result in material and environmental damage if it is not avoided.

Warning signs	Type of danger
	Warning – danger zone.

2 Safety instructions

Intended use

This device is intended to be used for amplification, mixing and playback of signals from musical instruments and microphones. Use the device only as described in this user manual. Any other use or use under other operating conditions is considered to be improper and may result in personal injury or property damage. No liability will be assumed for damages resulting from improper use.

This device may be used only by persons with sufficient physical, sensorial, and intellectual abilities and having corresponding knowledge and experience. Other persons may use this device only if they are supervised or instructed by a person who is responsible for their safety.

Safety

> **DANGER!**
> **Danger for children**
> Ensure that plastic bags, packaging, etc. are disposed of properly and are not within reach of babies and young children. Choking hazard!
>
> Ensure that children do not detach any small parts (e.g. knobs or the like) from the unit. They could swallow the pieces and choke!
>
> Never let children unattended use electrical devices.

> **NOTICE!**
> **Risk of fire**
> Do not block areas of ventilation. Do not install the device near any direct heat source. Keep the device away from naked flames.

> **NOTICE!**
> **Operating conditions**
> This device has been designed for indoor use only. To prevent damage, never expose the device to any liquid or moisture. Avoid direct sunlight, heavy dirt, and strong vibrations.
>
> Only operate the device within the ambient conditions specified in the chapter 'Technical specifications' of this user manual. Avoid heavy temperature fluctuations and do not switch the device on immediately after it was exposed to temperature fluctuations (for example after transport at low outside temperatures).
>
> Dust and dirt inside can damage the unit. When operated in harmful ambient conditions (dust, smoke, nicotine, fog, etc.), the unit should be maintained by qualified service personnel at regular intervals to prevent overheating and other malfunction.

> **!** **NOTICE!**
> **Possible damage due to installation of a wrong fuse**
> The use of different types of fuses can cause serious damage to the unit. Fire hazard!
>
> Only fuses of the same type may be used.

3 Features

- Digital speaker management system with FIR filter
- AD/DA converter
- 32-bit DSP
- 4 × XLR input sockets
- 8 × XLR output sockets
- Comprehensive setting options for optimal sound
  - Parametric Equalizer
  - Graphic Equalizer
  - High- and low-pass filters
  - Noise Gate
  - Limiter
  - Phase inversion
- USB connection for control via PC using the supplied software
- D-sub connector (RS232 / 485) for remote control of the device or cascading of several devices
- Ethernet interface (RJ45) for integration of the device into a local network
- Operation on the device via buttons, rotary switch and display

4 Installation and starting up

Unpack and check carefully there is no transportation damage before using the unit. Keep the equipment packaging. To fully protect the product against vibration, dust and moisture during transportation or storage use the original packaging or your own packaging material suitable for transport or storage, respectively.

Create all connections while the device is off. Use the shortest possible high-quality cables for all connections. Take care when running the cables to prevent tripping hazards.

Rack mounting

The unit has been designed for rack mounting in a standard 19-inch rack; it occupies one rack unit.
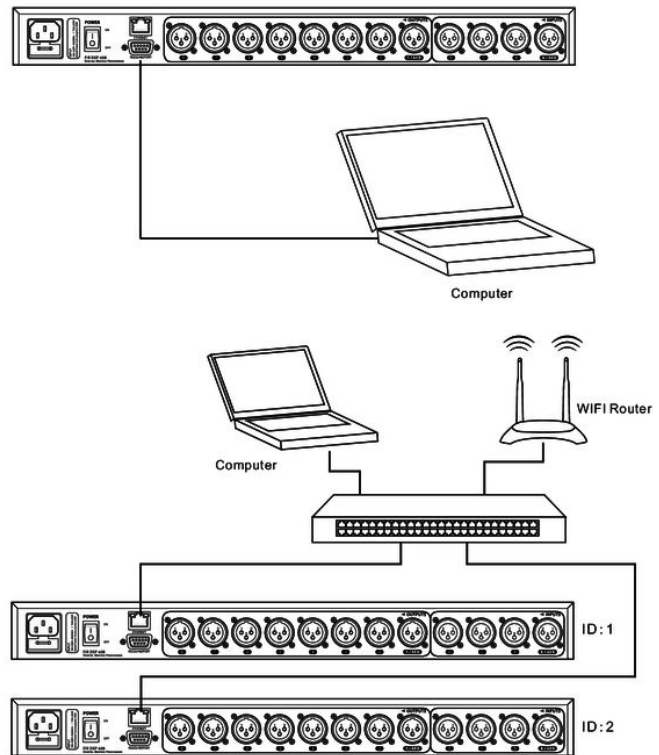
Configuration example 1

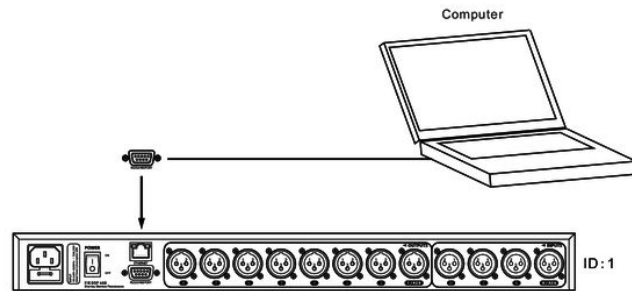The figure schematically shows how the device can be controlled via a computer's USB port.
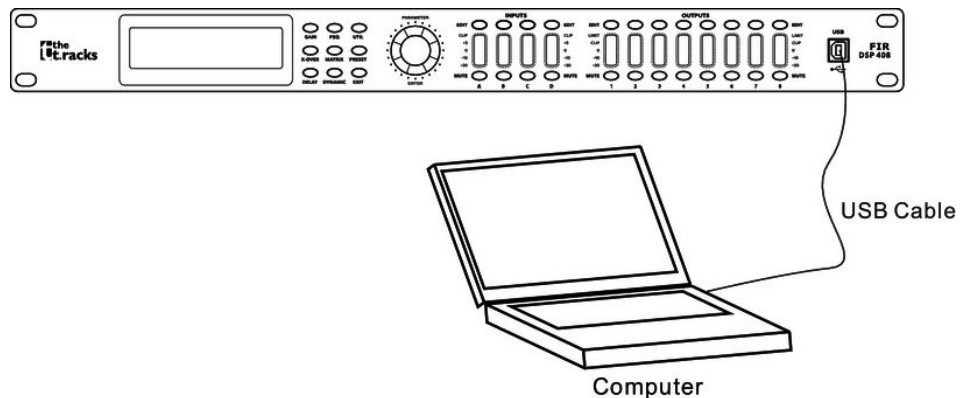
Configuration example 2

The illustrations show schematically how one device or several devices can be integrated into a local area network (LAN).
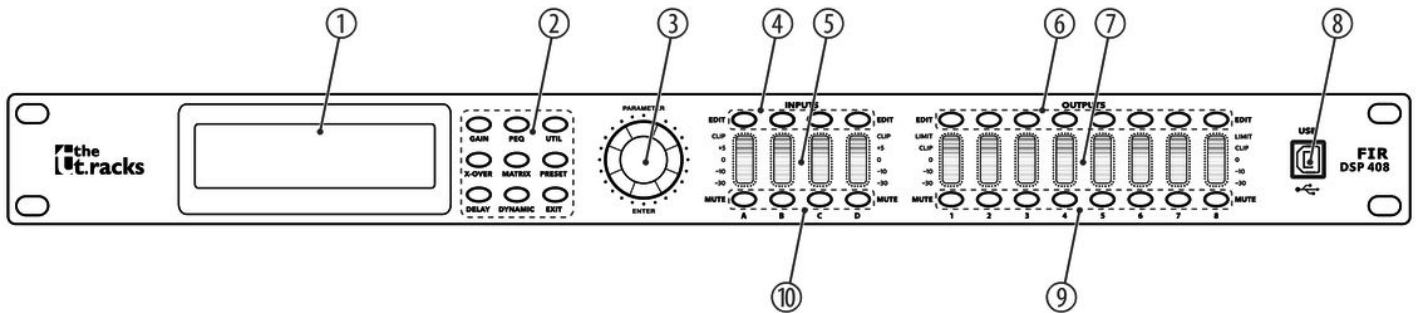
Configuration example 3

The illustrations show schematically how a device can be configured via the serial port.

5 Connections and controls

Front panel

1	Display
2	Buttons for direct selection of a parameter. Use *[EXIT]* to exit the Edit mode.
3	*[ENTER / PARAMETER]* Rotary switch
4	*[EDIT]* Buttons for selecting the Edit mode for the respective input channel. The set parameters of the selected channel appear in the display.
5	*[INPUTS]* Level meter for the input channels. The red *[CLIP]* LEDs indicate overloading (clipping). In this case, the level of the input signal is too high.
6	*[EDIT]* Buttons for selecting the Edit mode for the respective output channel. The set parameters of the selected channel appear in the display.
7	*[OUTPUTS]* Level meter for the output channels. The red *[CLIP]* LEDs indicate overloading (clipping). In this case, the level of the output signal is too high. The red *[LIMIT]* LEDs indicate that the built-in limiter has responded.
8	*[USB]* USB port

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9	*[MUTE]*
	Buttons for muting or unmuting the respective output channel
10	*[MUTE]*
	Buttons for muting or unmuting the respective input channel

Rear panel
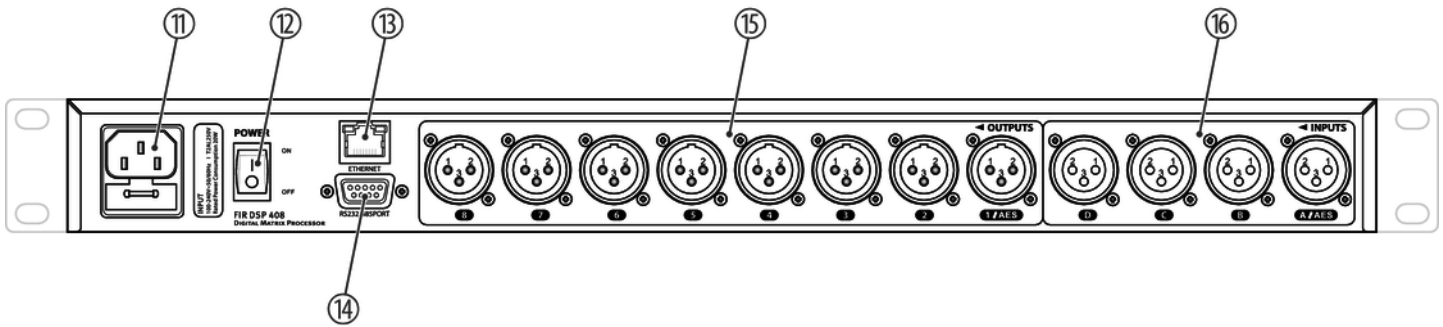
11	IEC chassis plug with fuse holder for the power supply
12	*[POWER]*
	Main switch. Turns the device on and off
13	*[ETHERNET]*
	RJ45 socket as LAN connection for connection to your network
14	*[RS232/485PORT]*
	D-sub connector for remote control of the device or cascading of several devices
15	*[OUTPUTS]*
	XLR chassis plugs for the output channels. The number of channels depends on the device version.
16	*[INPUTS]*
	XLR chassis sockets for the input channels. The number of channels depends on the device version.

6   Operating on the unit

Starting the device

Connect the device to the power grid and turn it on with the main switch to start operation. After a few seconds, the display indicates that a reset is in progress. The device is then ready for use. The display shows the model name and user preset currently active.

The device can only be operated directly with the buttons if it is not controlled via USB, LAN or the serial interface.

The currently usable buttons light up permanently, the last used ones flash. Currently unavailable buttons remain unlit.

Default settings

1. ▶ Press *[UTIL]* repeatedly until the desired parameter appears in the display.

   The table below shows the available parameters and their value ranges.

2. ▶ Use the rotary switch to set the desired value of the parameter. Press the rotary switch to confirm.

3. ▶ Press *[EXIT]*.

Parameter	Selection range	Meaning
'ID Number Select'	*'1'* … *'254'*	Unique identification of the device in a series connection. If multiple devices are connected in series, each must have a unique number.
'Manual IP Set'		If the device is integrated in a local network, its IP address can be set individually. The initial IP address is `192.168.1.101`.
'Input Select'	*'ANALOG'*	Analogue input
	'AES / EBU'	Digital input
'Output Select'	*'ANALOG'*	Analogue output
	'AES / EBU'	Digital output
'Unit Lock PassWord'	*'0000'* … *'ZZZZ'*	Four-digit device password. Any combination of numbers and letters is adjustable. The initial password is `1234`.
'In Source Select'	*'ANALOG INPUT'*, *'PINK NOISE'*, *'WHITE NOISE'*, *'SINE xx'*	Signal source selection: Either the analogue inputs or the internal test tone generator. The test tone generator optionally generates: Pink noise, white noise or a sine wave 20 Hz… 20 kHz.
'Copy CH select'		Transferring settings from one channel to another.
'LCD DISPLAY TIME'		Setting the backlight duration: Max. 200 ms

User presets

All device settings can be stored in up to 20 different user presets and recalled when needed. This allows you to easily restore your settings for different rooms or stage setups.

Recalling user preset

1. ▶ Press *[PRESET]*.

   ⇨ The menu *'Load preset'* opens up.

2. ▶ Use the rotary switch to select a user preset between *'U01'* and *'U20'* or the default setting *'F00'*. Press the rotary switch to confirm.

   ⇨ The settings are being loaded.

Saving user preset

1. ▶ Press *[PRESET]*.

   ⇨ The menu *'Store Preset'* opens up.

2. ▶ Use the rotary switch to select a user preset between *'U01'* and *'U20'*. Press the rotary switch to confirm.

3. ▶ Use the rotary switch to enter the name of the user preset by changing the default value `Default Preset`.

   ⇨ The settings are being saved.

4. ▶ Press *[EXIT]*.

Settings for the inputs

1. ▶ Press the *[EDIT]* button corresponding to the desired channel.

   ⇨ The settings menu for the desired channel opens up. The display shows *'GAIN'*.

2. ▶ In the default state of the menu, you can adjust the channel level in a range of -60 dB…+12 dB with the rotary switch.

3. ▶ To set additional parameters of the channel, press the corresponding button.

   Use the rotary switch to set the desired value of the parameter. Press the rotary switch to confirm.

   The table below shows the available parameters and their value ranges.

Parameter	Button	Selection range	Meaning
'PHASE'	*[GAIN]*	*'0'* , *'180'*	Phase reverse
'FIR BYPASS'	*[X-OVER]*		Bypassing the FIR filter; If no FIR filter is required, select *'ON'*.
'DELAY'	*[DELAY]*	*'0ms'* … *'680ms'* *'0m'* … *'234m'* *'0ft'* … *'766ft'*	Delay time. The displayed unit depends on the basic setting of the device.
'IN-LINK'	*[DELAY]*		The settings of several input channels can be linked together. If the current channel is *'INA'*, you can select *'INB'*, *'INC'* and *'IND'* to change the parameters simultaneously.
'FEQ'	*[PEQ]*	*'FEQ'*: *'1'* … *'9'* *'G'*: *'−12dB'* … *'+12dB'* *'FREQ'*: *'20Hz'* … *'20kHz'* *'Q'*: *'0.4'* … *'128'* *'Style'*: *'PEAK'*, *'L-SHLF'*, *'H-SHLF'*, *'LCUT'*, *'HCUT'*, *'A-PAS1'*, *'A-PAS2'* and *'BP'*	For 9 frequency bands (numbered with the parameter *'FEQ'*) you can set the parameters of the parametric equalizer: Centre frequency, filter quality, slew rate, filter type, on or off (bypass)
'GATE'	*[DYNAMIC]*	*'TH'*: *'−90dB'* … *'−0dB'* *'Hold'*: *'10ms'* … *'999ms'* *'AT'*: *'1ms'* … *'999ms'* *'REL'*: *'10ms'* … *'3000ms'*	Noise Gate parameters: Threshold, hold, attack, release
'COMPRESSOR'	*[DYNAMIC]*	*'T'*: *'−60dB'* … *'+20dB'* *'R'*: *'1:1'* … *'1:10'* *'K'*: *'0dB'* … *'12dB'* *'A'*: *'10ms'* … *'900ms'* *'R'*: *'10ms'* … *'3000ms'*	Compressor parameters: Threshold, ratio, soft knee, attack, release

Settings for the outputs

1. ▸ Press the *[EDIT]* button corresponding to the desired channel.

    ⇨ The settings menu for the desired channel opens up. The display shows *'GAIN'*.

2. ▸ In the default state of the menu, you can adjust the channel level in a range of -60 dB…+12 dB with the rotary switch.

3. ▸ To set additional parameters of the channel, press the corresponding button.

    Use the rotary switch to set the desired value of the parameter. Press the rotary switch to confirm.

    The table below shows the available parameters and their value ranges.

Parameter	Button	Selection range	Meaning
'PHASE'	*[GAIN]*	*'0'* , *'180'*	Phase reverse
'IIR'	*[X-OVER]*	*'HP'* : *'20Hz'* … *'20kHz'* *'LP'* : *'20Hz'* … *'20kHz'* *'BUTTER-xx'* (Butterworth), *'BESSEL-xx'* (Bessel), *'LINK/R-xx'* (Linkwitz-Riley) Slope: *'–6dB/oct'* … *'–48dB/oct'*	IIR filter. Digital high and low pass filter parameters: Cut-off frequency, filter type and slope
'FIR'	*[X-OVER]*	*'T'* : *'256'* … *'1024'* *'W'* *'BY'* *'HP'* : *'150Hz'* … *'20kHz'* *'LP'* : *'150Hz'* … *'20kHz'*	FIR filter. Number of FIR taps, FIR filter frequency response, bypass, cut-off frequencies for digital high-pass and low-pass
'DELAY'	*[DELAY]*	*'0ms'* … *'680ms'* *'0m'* … *'234m'* *'0ft'* … *'766ft'*	Delay time. The displayed unit depends on the basic setting of the device.
'OUT-LINK'	*[DELAY]*		The settings of several input channels can be linked together. If the current channel is *'OUT1'* , you can select *'OUT2'* … *'OUT8'* to change the parameters simultaneously.
'FEQ'	*[PEQ]*	*'FEQ'* : *'1'* … *'9'* *'G'* : *'–12dB'* … *'+12dB'* *'FREQ'* : *'20Hz'* … *'20kHz'* *'Q'* : *'0.4'* … *'128'* *'Style'* : *'PEAK'* , *'L-SHLF'* , *'H-SHLF'* , *'LCUT'* , *'HCUT'* , *'A-PAS1'* , *'A-PAS2'* and *'BP'*	For 9 frequency bands (numbered with the parameter *'FEQ'*) you can set the parameters of the parametric equalizer: Centre frequency, filter quality, slew rate, filter type, on or off (bypass).

Parameter	Button	Selection range	Meaning
'MATRIX'	[MATRIX]		Assignment selection of input channels to the respective output channel. To each output channel, an input channel or the mix of several input channels can be freely assigned.
'MIX'	[MATRIX]	'T': '–60dB' … '0dB'	For each of the input channels, which are assigned to the respective output channel, a level adjustment can be preset.
'LIMIT'	2 × [DYNAMIC]	'T': '–60dB' … '+20dB' 'R': '1:1' … '1:10' 'K': '0dB' … '12dB' 'AT': '10ms' … '999ms' 'REL': '10ms' … '3000ms'	Limiter parameters: Threshold, ratio, soft knee, attack, release.

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7 Operating on the computer

Install and start the software.

1. ▶ Insert the software CD into the disk drive of your Windows PC and start the installation programme that matches the device version.

2. ▶ Follow the instructions of the installation programme to completion.

3. ▶ Connect your PC to the device via a USB cable and turn on the device.

  ⇨ The operating system detects the newly added USB device.

4. ▶ Open the PC programme. It automatically detects the connected device.

  ⇨ In the upper right corner of the programme window the *'Online'* marking appears.

Exit software

1. ▶ In the programme window, click on the *'Online'* control.

2. ▶ Close the programme window.

Components of the programme window

All tabs of the programme window have a similar structure and are divided into the following areas:
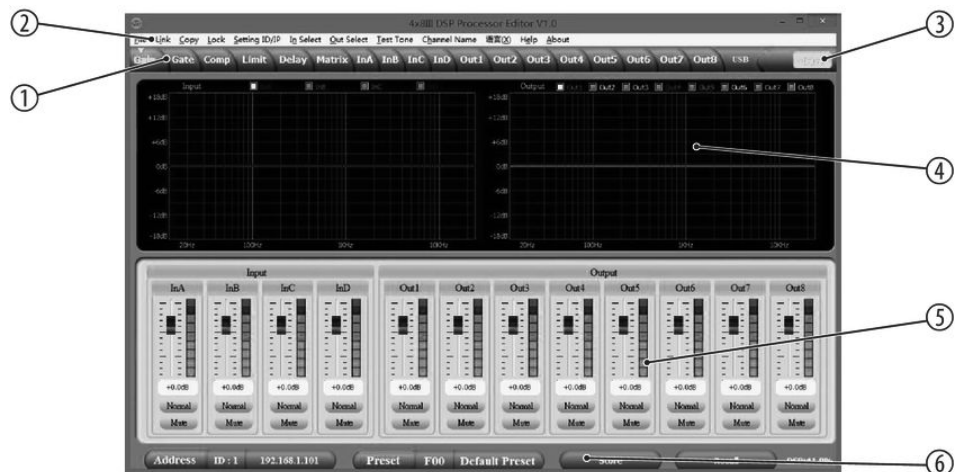
| 1 | Tab for selecting a function group |
2	Main menu
3	Button for the status of the connection to the PC
4	Display area
5	Control area
6	Buttons for quick access to important presets

Main menu

Menu item	Meaning
'File'	Loading user presets and saving them to the PC; Data upload to the PC and data download to the device
'Link'	Assignment of input to output channels
'Copy'	Copying parameter settings from one input or output channel to another
'Lock'	Changing device password
'Setting ID / IP'	Changing the unique identification of the device in a series connection or the IP address for the integration into a local network
'In Select'	Select 'AES / EBU' for digital or 'ANALOG'.
'Out Select'	Select 'AES / EBU' for digital or 'ANALOG'.
'Test Tone'	Setting the internal test tone generator: Pink noise, white noise, sine wave 20 Hz…20 kHz.
'Channel Name'	Renaming of input and output channels
'Language'	Language selection for the user interface of the programme (English or Chinese)
'Help'	Display of control codes for the serial interface
'About'	Information about the programme version

**Buttons for quick access to important presets**

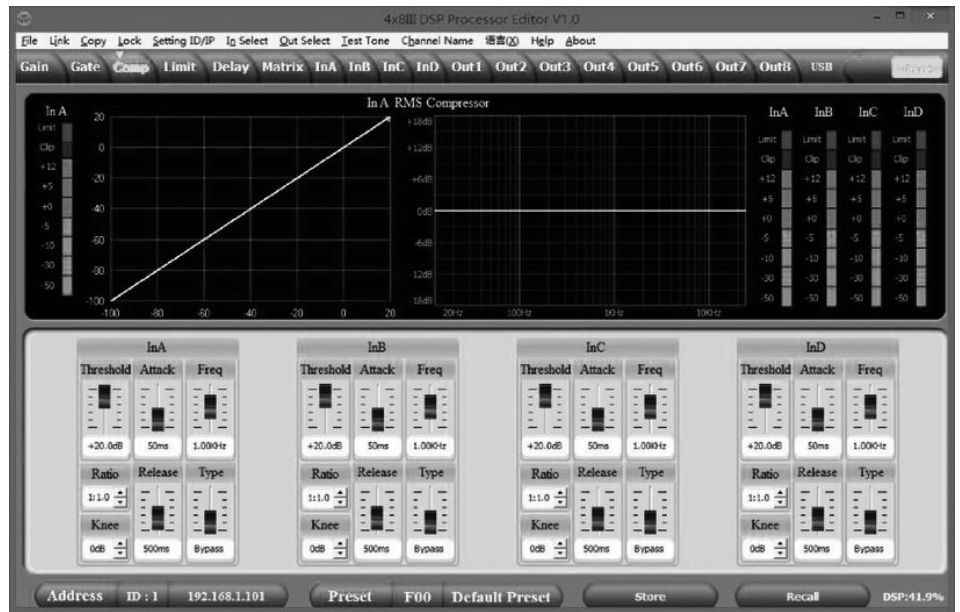| Range	Meaning
Address	Display of the device identification in a series connection and the IP address for integration into a local network
Preset	Display of the current user's preset
Store	Saving user preset
Recall	Recalling user preset

'Gain' tab
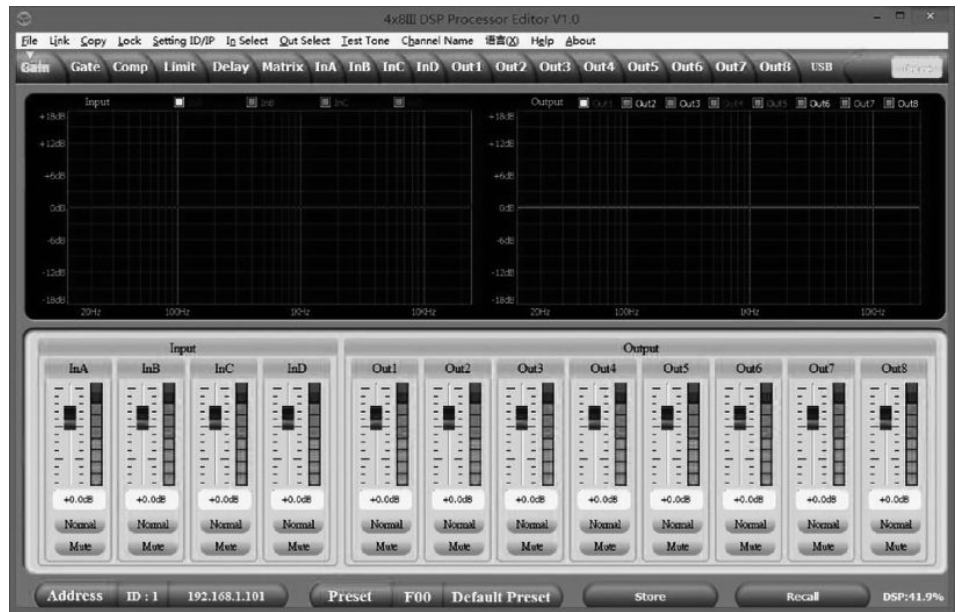
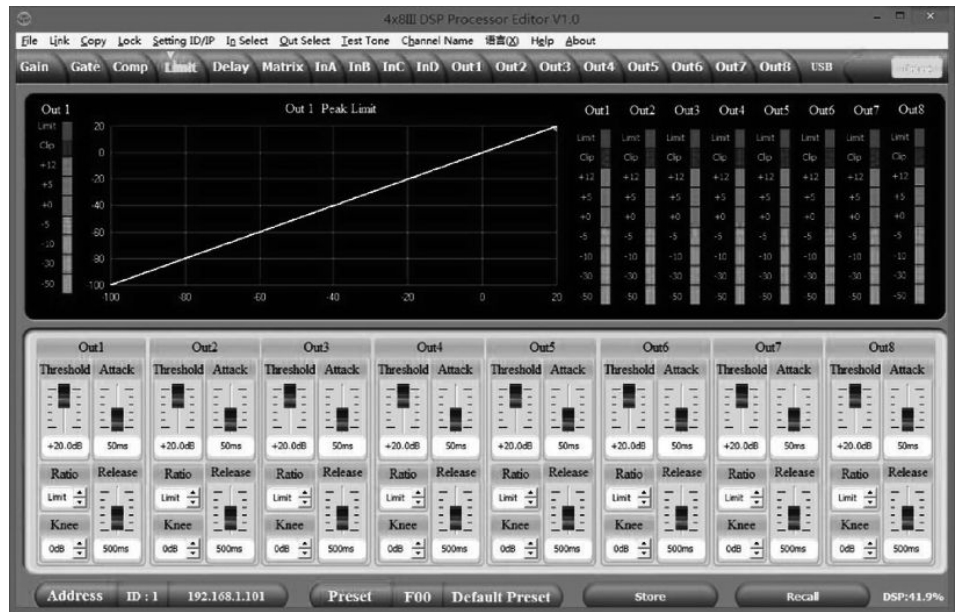| Range	Meaning
Display area	The waveform of input and output channels is graphically displayed. Use the radio buttons *'Inx'* and *'Outx'* to set the inputs and outputs to be displayed.
Control area	Drag the faders with the mouse to adjust the levels for the input and output channels. The *'Mute'* button mutes or unmutes the respective channel. The *'Normal'* / *'Inverse'* button inverts the phase of the respective channel by 180° when needed.

'Gate' tab
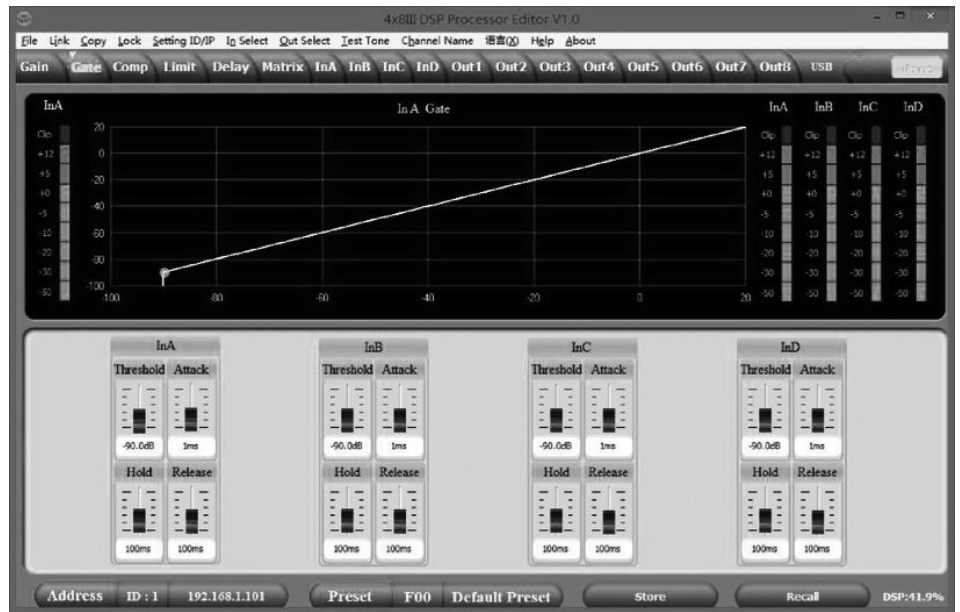
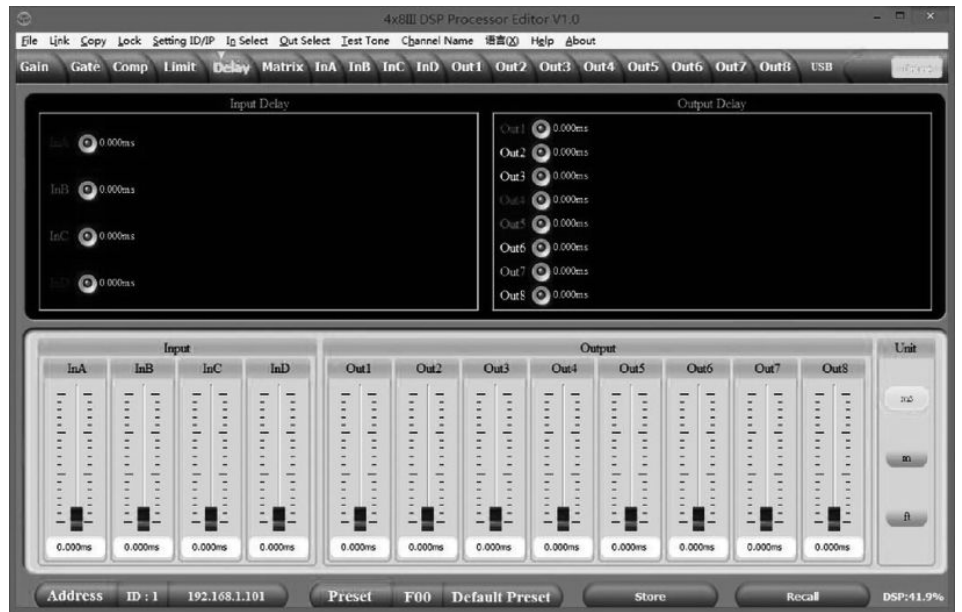| Range	Meaning
Display area	Shows the current settings of the noise gate for the respective channel, with a symbolic level indicator symbol appearing next to it for the input channels. The red dot in the curve corresponds to the current signal.
Control area	Drag the faders with the mouse to set the noise gate parameters for all input and output channels: Threshold, hold, attack, release.

'Comp' tab

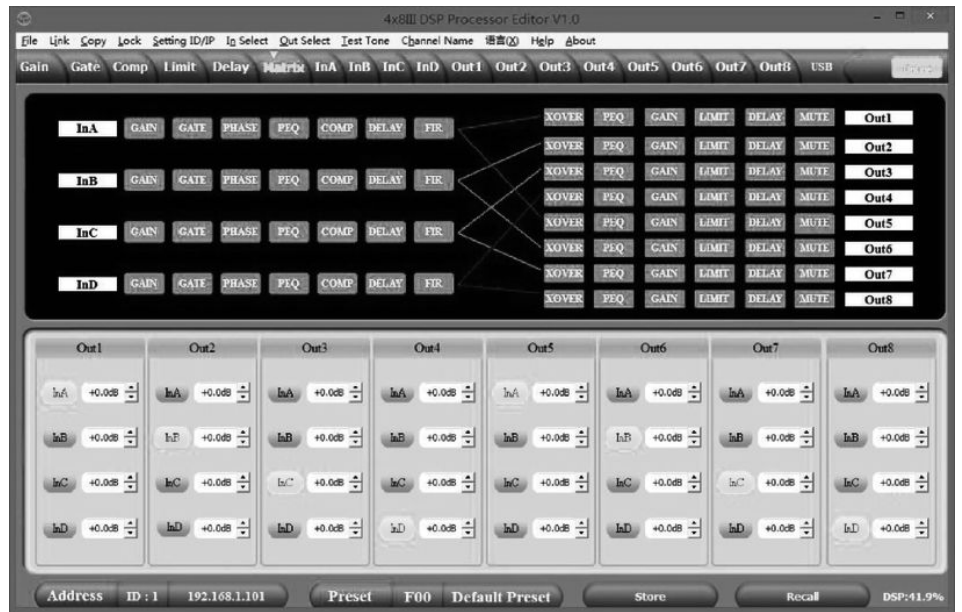| Range	Meaning
Display area	Shows the current settings of the compressor function for the respective output channel, with a symbolic level indicator symbol appearing next to it for all output channels. The red dot in the curve corresponds to the current signal.
Control area	Drag the faders with the mouse to set the compressor parameters for the output channels: Threshold, ratio, soft knee, attack, release, frequency, type.

'Limit' tab

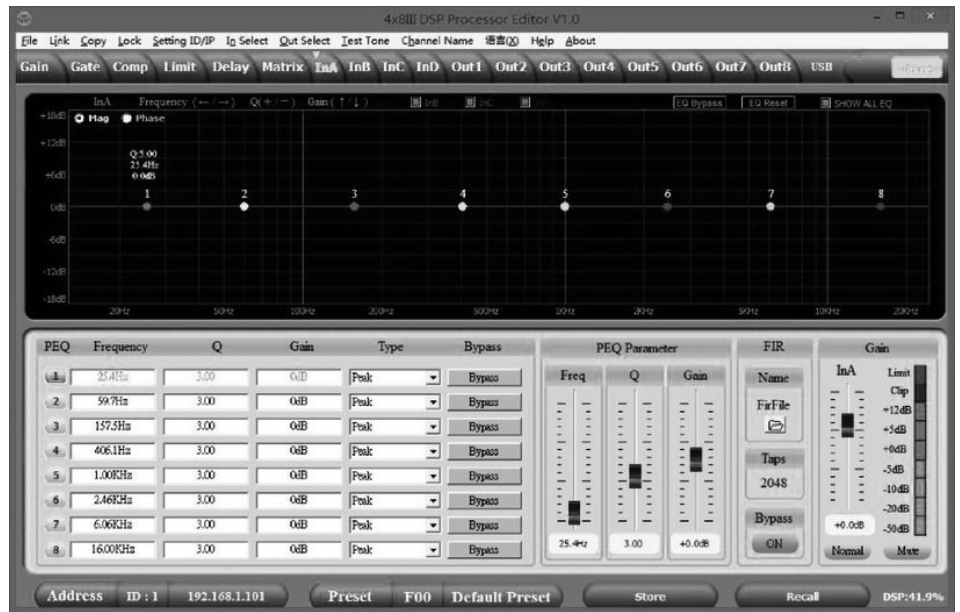| Range	Meaning
Display area	Shows the current settings of the limiter for the respective channel, with a symbolic level indicator appearing next to it for all channels.
Control area	Drag the faders with the mouse to set the limiter parameters for all input and output channels: Threshold, attack, ratio, soft knee, release.

'Delay' tab

Range	Meaning
Display area	Shows the set delays for all in and output channels.
Control area	Drag the faders with the mouse to adjust the delay for the respective channel. Press one of the buttons *'ms'*, *'m'* or *'ft'* to select the unit to be used.

'Matrix' tab

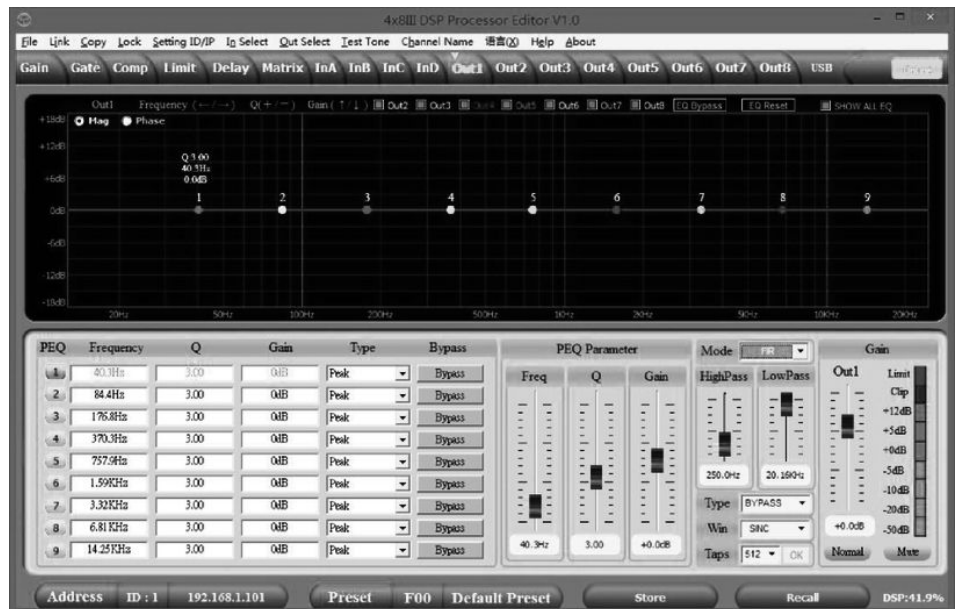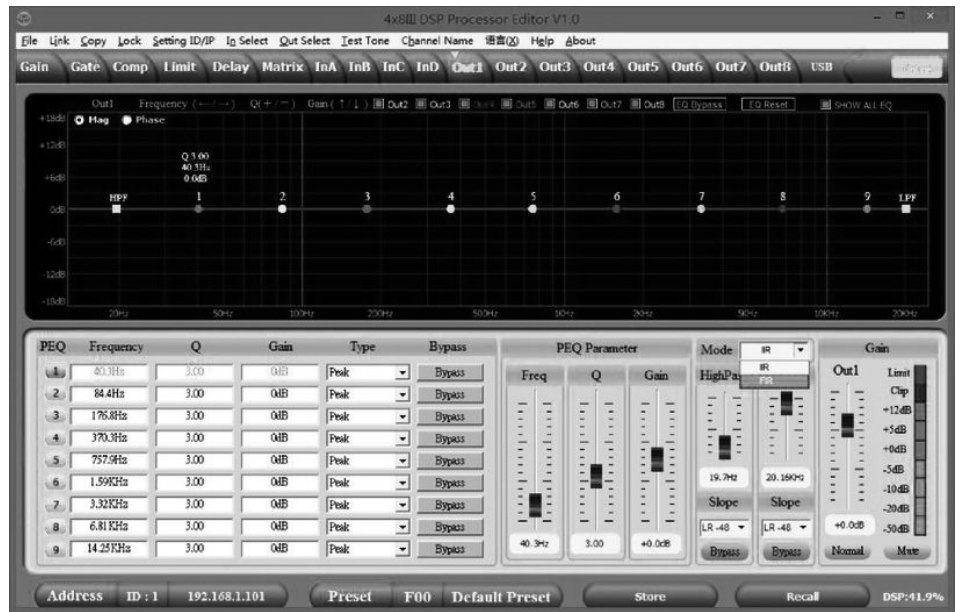| Range	Meaning
Display area	Shows the current interconnection of input to output channels. Input and output channels can be renamed. Click on a functional area (e.g. *'PEQ'* or *'DELAY'*) to open the tab where you can enter the corresponding parameters directly.
Control area	With a mouse click you can interconnect each input with each output channel. To each output channel, an input channel or the mix of several input channels can be freely assigned. The green input channels are assigned to the respective output channel. You can adjust the level for each combination of input and output channel.

'In' tab

Range	Meaning
Display area	Use the radio buttons *'Mag'* or *'Phase'* to switch the diagram from Cartesian coordinates (level vs. frequency) to polar coordinates (angle vs. frequency).
	Use the radio button *'SHOW ALL EQ'* to display the parameters for all nine frequency bands.
Control area	For each input channel and all nine frequency bands (numbered with *'PEQ'*) you can enter the parameters of the parametric equalizer directly as numerical values in the left part of the window: Centre frequency, filter quality, slope, filter type. With the *'Bypass'* button, the equalizer for the respective frequency band and the respective channel can be bypassed temporarily.
	In the middle part of the window (*'PEQ Parameter'*) you can adjust the parameters centre frequency, filter quality and slew rate with the faders or the arrow keys on the PC keyboard. The setting refers to the frequency band that is highlighted green in the left part of the window.
	The input channel can support 2048 FIR taps. To this, load the data in the folder *'Firfile'* (supported file formats: csv and txt). After import, the FIR coefficients are displayed, the *'PEQ'* diagram shows the *'FIR'* curve. Use the *'Bypass'* button to temporarily bypass the filter. Note: Since the FIR data is so extensive, only all channels together can support 4096 FIR taps. Each channel requires a homogeneous distribution of FIR resources and the PC software displays the size of the FIR resources in the lower right corner. Once exhausted, the PC software displays a warning message. Better use only 512 FIR taps. If you use more taps, the process time on the PC becomes considerably longer and leads to longer delays; when using 1024 taps, the delay is already more than 10 ms.
	Drag the fader in the right part of the window using the mouse to set the level for the input channel. The *'Mute'* button mutes or unmutes the respective channel. The *'Normal'* / *'Inverse'* button inverts the phase of the respective channel by 180° when needed.

'Out' tab

Range	Meaning
Display area	Use the radio buttons *'Mag'* or *'Phase'* to switch the diagram from Cartesian coordinates (level vs. frequency) to polar coordinates (angle vs. frequency).
	Use the radio button *'SHOW ALL EQ'* to display the parameters for all nine frequency bands.
Control area	For each output channel and all nine frequency bands (numbered with *'PEQ'*) you can enter the parameters of the parametric equalizer directly as numerical values in the left part of the window: Centre frequency, filter quality, slope, filter type. With the *'Bypass'* button, the equalizer for the respective frequency band and the respective channel can be bypassed temporarily.
	In the middle part of the window (*'PEQ Parameter'*) you can adjust the parameters centre frequency, filter quality and slew rate with the faders and the arrow keys on the PC keyboard. The setting refers to the frequency band that is highlighted green in the left part of the window.
	When the IIR filter is selected, you can select the cut-off frequency and filter type for the low-pass and high-pass filters. Use the *'Bypass'* button to temporarily bypass the filter.
	If you select the FIR filter, the PC software displays the FIR coefficients. You can select and adjust the type (low-pass, high-pass, frequency band) and set the cut-off frequency for the high-pass and low-pass filters. The FIR curve appears with numerous setting options. Here you can select the number of taps from *'512'* … *'1024'* (preset: 512). The FIR filter becomes active when you click *[OK]*. To import external FIR coefficients, select for *'TYPE'* *'External FIR'* and click on the file to be imported (supported file formats: csv and txt). The imported FIR-PEQ is displayed immediately in the FIR curve.
	Drag the fader in the right part of the window using the mouse to set the level for the output channel. The *'Mute'* button mutes or unmutes the respective channel. The *'Normal'* / *'Inverse'* button inverts the phase of the respective channel by 180° when needed.

8 Technical specifications

Inputs	Type	XLR chassis socket (balanced)	
	Level	+18 dBu (max.)	
	Impedance	1 MΩ (stereo), 500 kΩ (mono)	
Outputs	Type	XLR chassis plug (balanced)	
	Level	+20 dBu (max.)	
	Impedance	< 500 Ω	
Frequency response		20 Hz … 20 kHz, −0.3 dBu	
THD		< 0.005 % (1 kHz, 0 dBu)	
Signal-to-noise ratio		> 115 dBu	
Crosstalk		< 100 dB	
Digital signal processor	Resolution	24 bit	
	Sampling rate	96 kHz	
Voltage supply		AC 95 – 240 V∼ 50/60 Hz	
Power consumption		20 W	
Fuse		5 mm × 20 mm, 2 A, 250 V, fast-acting	
Dimensions (W × H × D)		482 mm × 44 mm (1 RU) × 247 mm	
Weight		2.7 kg	
Ambient conditions		Temperature range	0 ℃…40 ℃
		Relative humidity	50 %, non-condensing

Further information

| Channels	4
Number of frequency bands	9
Tube	No

9 Plug and connection assignment

Introduction

This chapter will help you select the right cables and plugs to connect your valuable equipment in such a way that a perfect sound experience is ensured.

Please note these advices, because especially in 'Sound & Light' caution is indicated: Even if a plug fits into the socket, an incorrect connection may result in a destroyed power amp, a short circuit or 'just' in poor transmission quality!

XLR plug (balanced)
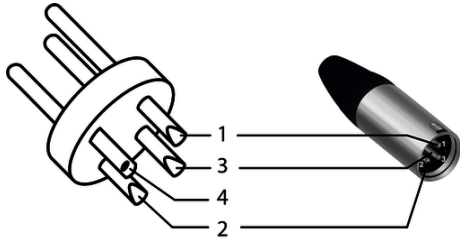
1	Ground, shielding
2	Signal (in phase, +)
3	Signal (out of phase, −)
4	Shielding on plug housing (option)

10   Protecting the environment

Disposal of the packaging material

For the transport and protective packaging, environmentally friendly materials have been chosen that can be supplied to normal recycling.

Ensure that plastic bags, packaging, etc. are properly disposed of.

Do not just dispose of these materials with your normal household waste, but make sure that they are collected for recycling. Please follow the notes and markings on the packaging.

Disposal of your old device

This product is subject to the European Waste Electrical and Electronic Equipment Directive (WEEE) in its currently valid version. Do not dispose with your normal household waste.

Dispose of this device through an approved waste disposal firm or through your local waste facility. When discarding the device, comply with the rules and regulations that apply in your country. If in doubt, consult your local waste disposal facility.

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