



Manual for HD2 and HD2ControlV2



Version 1077.0

05.07.2010

© Four Audio GmbH & Co. KG 2010

Four Audio GmbH & Co. KG
 Bergdriesch 24-26
 52062 Aachen
 Germany
 Phone: +49 241 4758 3170
 Fax: +49 241-4758 3169

Seat: Aachen,
 Entry in the commercial register
 at the Local Court Aachen:
 HRA6830
 Partner liable to unlimited
 extent:

Four Audio Verwaltungsgesellschaft mbH,
 Seat: Aachen
 Entry in the commercial register at the local
 court Aachen: HRB 14189
 Managing director:
 Dr.-Ing. Rainer Thaden

Contents

1	Important Safety Information.....	3
2	Product Specifications.....	4
3	HD2 In- and Outputs.....	5
3.1	Analog Inputs.....	5
3.2	Analog Outputs.....	5
3.3	Digital Inputs and Outputs.....	6
4	Front panel.....	7
5	Basic Usage.....	10
5.1	Network Setup.....	10
5.1.1	Resetting To The Default IP Address (192.168.1.15).....	11
5.1.2	Setting A Specified IP Address.....	11
5.1.3	Network troubleshooting.....	11
6	The remote software HD2Control.....	12
6.1	Installation.....	12
6.2	Starting the Software.....	12
6.2.1	Main Menu.....	13
6.2.2	Main Frame.....	13
6.2.2.1	Network Monitor.....	13
6.2.2.2	Status Monitor.....	14
6.3	Establishing a connection to the HD2.....	15
6.4	Basic Concept of Operation.....	17
6.4.1	Status Bar.....	17
6.5	System Tab (simple mode).....	17
6.5.1	Selecting (Recalling) a Setup.....	17
6.5.2	Select Different Input.....	17
6.6	Advanced Tab.....	18
6.6.1	FIR Filters.....	18
6.6.2	Setups.....	19
6.6.3	Configuration Wizard.....	19
6.6.4	Firmware Update.....	23
6.6.5	Erase Flash Mem / Reset to Factory Defaults.....	24
6.6.6	Download / Upload the Complete Configuration.....	24
6.6.7	Locking/disabling the front panel operation.....	24
6.6.8	Change the 4 digit security PIN.....	24
6.7	In-/Outputs Tab.....	25
6.8	Limiter Tab.....	27
6.9	Input and Output Tabs.....	28

1 Important Safety Information

This device has been manufactured and tested with your safety in mind. However, improper use can result in potential electric shock or fire hazards.

To avoid defeating the safeguards that have been built into the device, please observe the precautions discussed in this document.

Warnings on the device



The lightning flash with arrowhead symbol, within a triangle, is intended to alert you to the presence of uninsulated “dangerous” voltages within your device’s enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

The exclamation point within a triangle is intended to alert you to the presence of important instructions in the literature accompanying the device.

Other warnings

TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE THE COVER OF THE DEVICE.
THERE ARE NO USER-SERVICEABLE PARTS INSIDE IT.

TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS DEVICE TO RAIN OR MOISTURE.

DO NOT PERFORM ANY SERVICING UNLESS YOU ARE QUALIFIED TO DO SO BY FOUR AUDIO.
REFER ALL SERVICING TO QUALIFIED SERVICE PERSONNEL.
SERVICING THE DEVICE YOURSELF WILL INVALIDATE THE WARRANTY.

Ventilation

Slots and openings in the casing of the device are provided for ventilation, to ensure reliable operation of the device and to protect it from overheating.

Never block the ventilation openings by placing the device on a bed, sofa, rug or other similar surface;

Never cover the ventilation openings with items such as newspapers, table-cloths etc.

Do not place the device in a built-in installation such as a bookcase or rack unless proper ventilation is provided or you have adhered to the manufacturer’s instructions;

Water and moisture

Do not expose this device to dripping or splashing and ensure that no objects filled with liquids, such as vases, are placed on the device

SAVE THIS INFORMATION FOR FUTURE REFERENCE

2 Product Specifications

Analog Inputs	4
Analog Outputs	8
Digital Inputs	2
Digital Outputs	2
Interfaces	Ethernet / RS232

Digital Inputs

Type	AES/EBU / S/P-DIF / Optical
Resolution	24 bit
Samplingrate	32-192 kHz

Digital Outputs

Type	AES/EBU / S/P-DIF / Optical
Resolution	24 bit
Samplingrate	48 / 96 / 192 kHz

Audio Performance

Analog Inputs

Max. Input Level	+28 dBu
Dynamic Range (linear weighted)	132 dB
THD @ +4 dBu input level	-118 dB
THD @ +21 dBu input level	-110 dB
DIM100 @ +4 dBu input level	-95 dB
DIM100 @ +21 dBu input level	-95 dB

Analog Outputs

Max. Output Level	+18 dBu
Dynamic Range (linear weighted)	120 dB
THD @ +4 dBu output level	-105 dB
THD @ +16 dBu output level	-95 dB
DIM100 @ +4 dBu output level	-85 dB
DIM100 @ +16 dBu output level	-85 dB

3 HD2 In- and Outputs

The full-blown HD2 provides several in- and outputs:

1. 2 dual range analog inputs (XLR) or optionally 4 single range inputs (XLR)
2. 8 analog outputs (XLR)
3. 2 digital inputs (selectable: balanced XLR or opto)
4. 2 digital outputs (balanced XLR and opto)
5. 1 Ethernet jack
6. 1 RS 232 connector

In detail

3.1 Analog Inputs

The HD2 provides 2 stereo AD converters with a maximum input voltage of 28.5 dBu.

They can be operated in stacked/dual range or unstacked/single range mode. In stacked/dual range mode, the left and right channel of one AD converter are combined to form a dual range converter with a higher dynamic range. The first versions of HD2 usually are set to stacked mode. In later versions, the AD converter operation mode can be set by software.

Input jack (label)	Function (stacked/dual range)	Function (single range)
A	ADC 0 stacked	ADC 0 left
B	---	ADC 0 right
C	ADC 1 stacked	ADC 1 left
D	---	ADC 1 right

Early versions:

Early versions have 4 input XLR jacks labelled 1/3, 2/4, 5 and 6. In the housing near the input jacks, switches are provided to select between inputs 1 and 3 between inputs 2 and 4. In case, a 3rd AD converter is provided, its inputs are statically connected to inputs labelled 5 and 6.

Input jack (label)	Function (stacked/dual range)	Function (single range)
1/3	ADC 0 stacked	ADC 0 or 1 left
2/4	ADC 1 stacked	ADC 0 or 1 right
5	ADC 2 left	ADC 2 left
6	ADC2 right	ADC 2 right

3.2 Analog Outputs

The 8 analog outputs provide a dynamic range of 121 dB with a maximum output voltage of 18 dBu. Their use is rather straight-forward. No extra configuration is necessary and no dependence on the ADC configuration exists. The following table is valid for 2x1->4 routing with the left channel input connected to Input A and the right channel input connected to Input C.

Output jack	Function
1	Sub left
2	Low left
3	Mid left
4	High left
5	Sub right
6	Low right
7	Mid right
8	High right

3.3 Digital Inputs and Outputs

As digital in- and outputs, a balanced AES/EBU in-/output as well as an optical in-/output are provided. These can be selected in the routing options of the remote software.

Only one 2-channel input at a time can be used, that is, either opto or XLR. The 2-channel output is always available at the opto and XLR jacks.

4 Front panel

On the front panel, LED bargraphs for input and output level as well as LEDs signalling several states can be found. Below each bargraph, switches for selecting / muting the channel are provided.

Besides the output level meters, a gain reduction meter is provided for each of the 8 outputs. The red LEDs provide information about the gain reduction induced by the peak limiter. That is, if the level exceeds 0 dB, the peak limiter limits the signal to not exceed the allowed threshold.

Additionally, an RMS limiter, based on a thermal model of the speakers' voice coil reduces the gain when the (modelled) temperature exceeds a threshold. The activity of the RMS or temperature limiter is signalled by the letters **TEM** glowing red beneath the gain reduction LEDs.

With the buttons beneath the output LED bargraph labelled 1 to 8, the single channels can be muted. A muted channel is signalled by the letters **OFF** glowing red.

The **SEL** LED flashes when the user enters the mode to set gain or delay for one of the input or output channels. The LED display, then, shows the gain / delay for the channel with SEL flashing. The button below each channel, then, operates as a select button instead of a mute button.

The input display section consists of 4 level meters and several status LEDs.

CLP: input signal clips

DRC: if lit, input operates in dual range (stacked) mode

ANA: analog input is active on this channel

DIG: digital input is active on this channel

LCK: digital input successfully locked onto the signal

SRC: sample rate converter is used

OFF: input has been muted by the user.

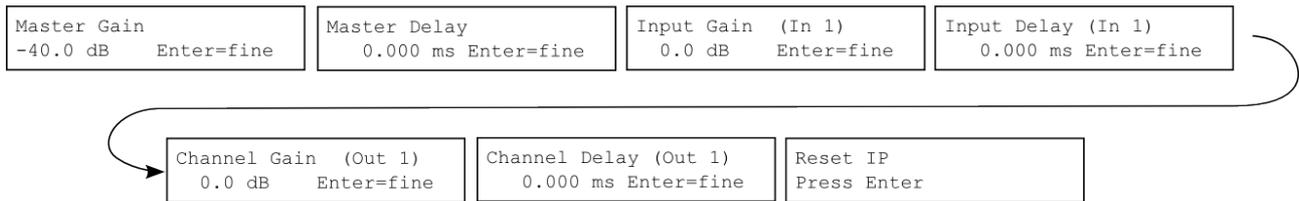
The HD2 can be configured via 8 buttons and a knob which provides an „Enter“ function when pushed (see Fig. 1)



Fig. 1: Buttons for front panel operation

The front panel operations are not yet fully completed. Thus, the buttons MENU and PARAM are non-functional. With STORE and RECALL, menus can be entered which allow to store and recall setups from a list. The PAGE keys navigate through the adjustable settings. After starting up, the HD2 is in the Master Gain menu. From here, operation of PAGE → brings up the menus as shown in the following picture:

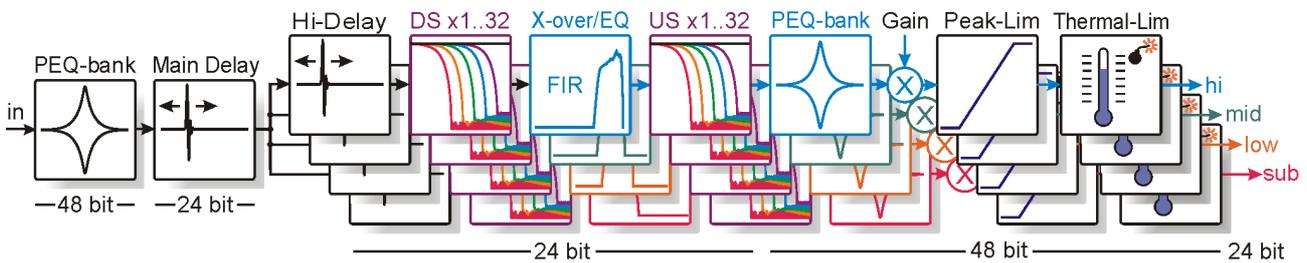
<- PAGE ->



<- PAGE ->

Parameters can be adjusted by turning the knob. Pushing the knob changes the step size between fine and coarse. To store or recall setups, enter the menu by pushing RECALL or STORE, select the setup and push enter.

With the help of the following figure of the internal processing in one of the two DSPs, the adjustable parameters shall be explained briefly.



Master Gain

Function: Overall gain applied to every path.

Position: Behind the FIR filter block and PEQ bank.

Range: From -88.5 to 39.0 dB

Comments: The default maximum voltage for the AD converters is 28.5 dBu (26.6 Vpp) while the DAC output voltage range is 18 dBu (7.94 Vpp). Thus, there is a "loss" of 10.5 dB inside the HD2. To obtain a neutral behaviour with 0 dB gain, the master gain has to be set to 10.5 dB.

Note: From Firmware 1073 upwards, the master gain behaviour has changed. The range depends on the selected configuration. For analog inputs, master gain ranges from -108.0 to +19.5 dB. A gain of 0 dB, then, provides neutral behaviour.

Master Delay

Function: Overall delay applied to every input

Position: After the PEQ-Bank in the input path

Range: Minimum: 0. Maximum depends on the delay used in the FIR filter and the outputs.

Comments: The delay uses a variant memory pool inside the DSP. That is, if e.g. a high master delay is used, the maximum channel delay decreases and vice versa.

Input Gain

Function: Input specific gain. Influences input and all connected outputs

Position: After the PEQ-Bank in the input path

Range: -18 to +6 dB

Comments: In this menu, the input to be adjusted is shown on the display and indicated by a lit SEL

LED at the corresponding input indicators. To change the input, push the button below the indicator.

Input Delay

Function: Input specific delay. Influences input and all connected outputs

Position: After the PEQ-Bank in the input path

Range: Minimum: 0. Maximum depends on the delay used in the FIR filter and the outputs.

Comments: In this menu, the input to be adjusted is shown on the display and indicated by a lit **SEL** LED at the corresponding input indicators. To change the input, push the button below the indicator.

Channel Gain

Function: Output specific gain

Position: After the PEQ-Bank in the output path

Range: -18 to +12 dB

Comments: In this menu, the output to be adjusted is shown on the display and indicated by a lit **SEL** LED at the corresponding output indicators. To change the output, push the button below the indicator.

Channel Delay

Function: Overall delay applied to every input

Position: After the PEQ-Bank in the input path

Range: Minimum: 0. Maximum depends on the delay used in the FIR filter and the outputs.

Comments: The delay uses a variant memory pool inside the DSP. That is, if e.g. a high master delay is used, the maximum channel delay decreases and vice versa.

In this menu, the input to be adjusted is shown on the display and indicated by a lit **SEL** LED at the corresponding input indicators. To change the input, push the button below the indicator.

Reset IP

Pushing the knob in this menu resets the IP to the default value 192.168.1.15. After restarting the HD2, it uses this IP.

Comments: If the HD2 is connected to a DHCP router, this setting has no effect, since the IP assigned by the router is used.

Additionally, a LED labelled **ACT** shows network activity in general, while **REM** signals network activity for this very HD2.

Earlier versions:

Earlier versions differ from the description as follows:

1. **OFF** is called **MUT**
2. the levels are given relative to full scale.
3. **DRC** LED is not provided

5 Basic Usage

The HD2 needs to be connected to its audio sources and sinks, of course. It works with different programs for its DSPs according to the loudspeaker configuration (number of ways, mode of equalization, downsampling rates, etc.) and with different FIR filters (if FIR equalization is selected). The setups and filters can be uploaded from the PC or downloaded to the PC and stored on disk. The DSP programs are uploaded automatically. The user can just forget about them.

In total 255 files can be uploaded to the HD2. These files can either contain FIR filters, setups or DSP programs. In practice, the user will usually not come near this limit.

The setups contain the total state of the HD2, that is, the routing setup, selected programs and filters, EQ settings etc. Also the FIR filters are stored in the setup. You can download the setup to the hard disk and transfer it to another HD2. Since all necessary information is inside the setup, the user just has to recall the setup in the second HD2 which will behave just like the source HD2.

5.1 Network Setup

To configure the HD2 externally via a remote PC, it contains a network chip with an own MAC address which is unique for the HD2. Thus, the HD2 has to be integrated in a network via its Ethernet connector which can happen in two different ways:

1. If the network is managed by a DHCP server, the HD2 will automatically obtain an own IP.
2. If only static IP addresses without any DHCP server are used, you have to establish a connection between the remote PC and the HD2 either directly via an Ethernet patch cable or by using a switch. Connect the HD2s and the PC to the switch. The HD2s then must have different IP addresses which share the subnet with the PC's IP address.

The HD2 communicates with the remote PC via two different protocols: UDP and TCP/IP. For this to work, the network in the PC has to be set up appropriately. The TCP connection is used for controlling the devices. The UDP protocol handles search queries and status information.

In case that a DHCP server is used in the network and the PC is already connected to the network, no further actions are required.

If direct communication between PC and HD2 is desired, the both PC and HD2 have to be in the same subnet. The default IP address of the HD2 is 192.168.1.15. Thus, open the network configuration on your PC and modify the properties of the TCP/IP protocol such that the PC has an IP address in the same subnet, e.g. 192.168.1.1.

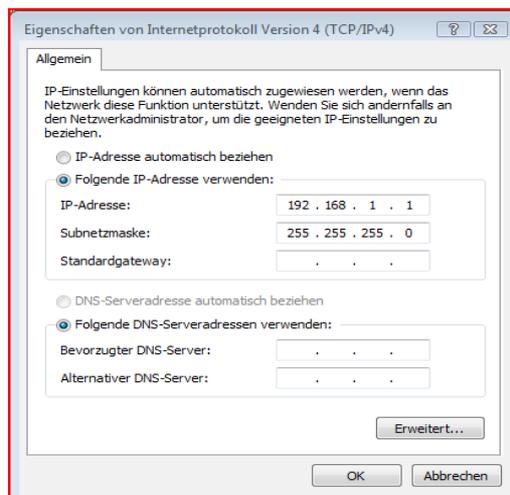


Fig. 2: TCP/IP configuration

If you are using more than one HD2s at a time, you have to assign different IP addresses. This is described in section 3.1.1 and 3.1.2 below.

5.1.1 Resetting To The Default IP Address (192.168.1.15)

Power on the HD2 and wait until the HD2 has finished booting. Then, use the Page keys on the front panel and enter the Menu 'Reset IP'. Push the knob. You get a message 'IP reset to 192.168.1.15).
Restart the HD2.

5.1.2 Setting A Specified IP Address

Start the HD2Control software (described below). Connect to the HD2 (at 192.168.1.15). When connected, enter the desired IP address in the IP address field on the top left and click [Set IP](#).

Restart the HD2.

5.1.3 Network troubleshooting

In case that network operation is not working, this checklist may be helpful:

Assuming that the HD2 has an IP address of 192.168.1.15:

- Try to access the HD2 by opening a console, typing 'ping 192.168.1.15' and see, if it reacts.
- The console can be found under Start → Programs → Accessories.

If you get no response:

Did you use the right cable?

- crossover cable if directly connected to PC
- standard patch cable if connected to router/switch/hub.

Firewall active?

- configure it to not block port 5000

Windows network settings OK?

- TCP/IP protocol installed?
 - This is true, if internet access works

If direct connection is selected:

- try to access a second PC
 - connect to a second PC via crossover ethernet cable
 - look up the IP address of the second PC by typing 'ipconfig' in console on that PC (look for IPv4 address)
 - Enter 'ping <ip address of second PC>
 - If that succeeds, TCP/IP works in principle.

If the above advices aren't successful, ask an experienced network administrator with nerves of steel.

6 The remote software HD2Control

The remote control software HD2Control only consists of an executable file called „HD2ControlV2.exe“.

6.1 Installation

The software package comes in a zipped file containing the following files

HD2Control.exe	The executable file
HD2_1077.0.fwu	HD2 firmware to be flashed into HD2

To install the software, extract the zip file contents into a directory of your own choice.

The directory which HD2Control.exe resides in must have write access for the current user. A HD2_Config directory will be created to store temporary data.

6.2 Starting the Software

The software is started by executing HD2ControlV2.exe.

You'll see the following GUI

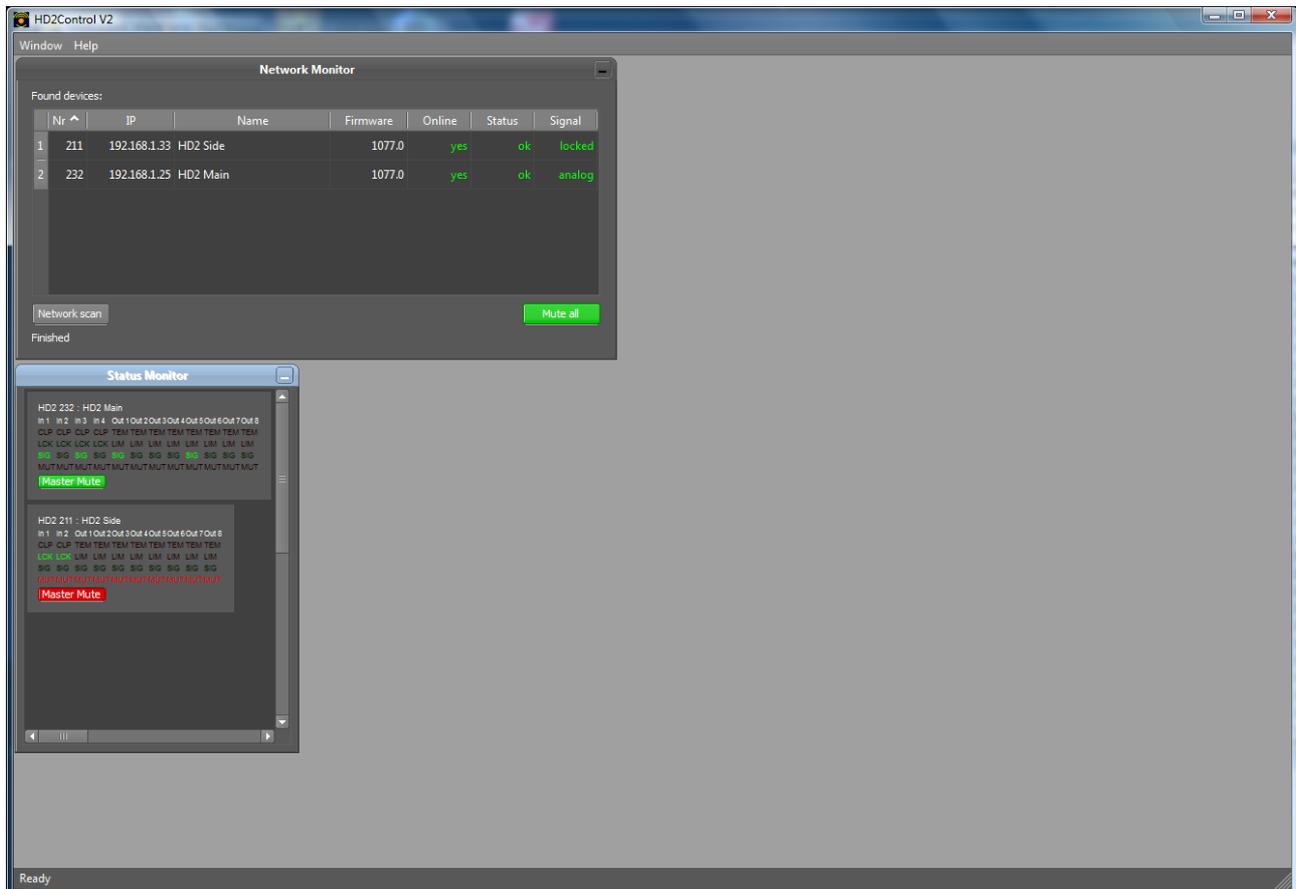


Fig. 3: HD2ControlV2 software after startup

The list of devices in the network monitor is automatically being filled since the software queries the network for devices using the UDP protocol. The devices respond to these queries without the user having to set up any connections. The most important data on the devices are shown in the list.

All windows can be changed in size to fit them to the displayed data.

6.2.1 Main Menu

The main menu consists of only 2 main entries: Window and Help.

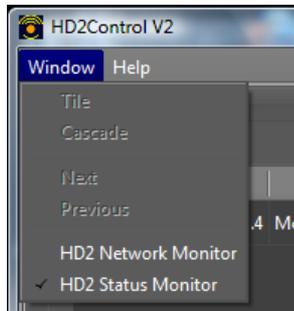


Fig. 4: Window Menu

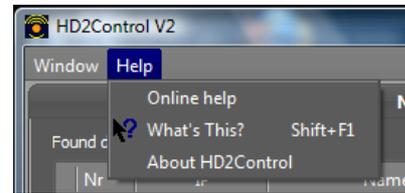


Fig. 5: Help Menu

The [Window](#) menu contains controls to activate or rearrange the windows in the main fram

The [Help](#) menu contains the following entries

[Online Help](#) opens this document, if it is placed in the same directory as the executable file HD2ControlV2.exe

[What's This](#) can be used to display help messages directly in the application. After selecting this entry, move the cursor over the GUI. Where it changes to an arrow with a question mark, a help message is available. Click once to display the message. This feature can also be activated by pressing Shift+F1.

6.2.2 Main Frame

Inside the main frame, several windows can be arranged. Directly after starting the application, the following windows are displayed

6.2.2.1 Network Monitor

The network monitor displays information about the HD2 devices in the network. The software queries the network for devices periodically and displays all found devices automatically, if they use the firmware with a number higher than 1077. Devices with older firmware have to be scanned for manually by clicking [Network Scan](#).

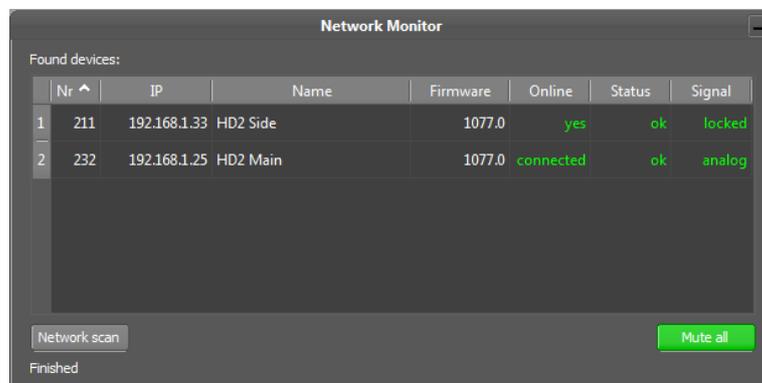


Fig. 6: The network monitor window

This dialog provides an overview of all devices attached to the network. The user can

Sort the list by clicking on the column headers.

Establish a connection to a device by double clicking a row. Double clicking a row when a device is already connected brings the corresponding control window on top.

Identify the HD2 widget in the Status Monitor by single clicking a row. The corresponding widget in the status monitor will fade and reappear shortly.

The properties shown in the list are

- Serial** the serial number of the device.
- IP** the internet protocol address of the device
- Name** the name of the HD2 which can be set by the user or the name of the current setup, if any.
- Firmware** the version of the firmware, currently installed on the HD2.
- Online** when the HD2 responded to a UDP broadcast, this field is set to **yes**. If no response is received for about 8 seconds, it is set to **no**. When a connection is established to any computer (*not necessarily this one!*), it is set to **connected**. *Only one* TCP connection at a time is possible.
- Status** the error status of the HD2. If an error occurs, **Err [nr]** is shown. Contact Four Audio to solve the problem.
- Signal** the status of the digital input, if any. If a digital source is connected, this field shows **locked** otherwise **not locked**. If only analog inputs are selected, the field shows **analog**.

The button **Network Scan** must be used to find HD2s with a firmware version lower than 1077, since these devices do not respond to UDP broadcasts. Instead, Ping requests will be sent to all connected subnets. Note: for these devices, status and signal will not be updated correctly.

The button **Mute All** can be used as a *panic button* to silence all connected devices. This is possible even if no TCP connection is active, since this command is send via the UDP protocol.

6.2.2.2 Status Monitor

The status monitor shows the most important information on the HD2 without having to establish a TCP connection (and wasting network traffic this way). The HD2 sends small UDP packets with status information in intervals of 50 ms to update this display.

For each HD2 found in the network, a small status widget appears with the following information displayed:

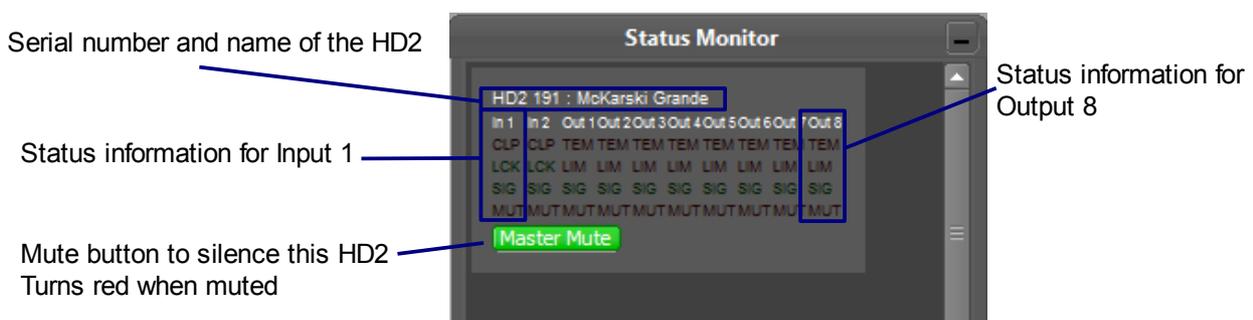


Fig. 7: The Status Monitor

The letters will flash indicating different states for in- and outputs.

For the **inputs**, the letters represent the following states:

CLP	Flashing red, indicates clipping at the input, i.e. the input level exceeds the maximum input voltage (28 dBu for the analog inputs, usually).
LCK	Steady green, indicates the a digital input is locked to the data source. For analog inputs, this display is not relevant.
SIG	Flashing green, indicates that a signal is present at the input, that is, the signal exceeds a certain threshold. This threshold is fixed, currently, but will be user configurable in the future.
MUT	Steady red, indicates the the input was muted by the user

For the **outputs**, the letters represent

TEM	Flashing red, indicates that the RMS or thermal limiter is active.
LIM	Flashing red, indicates that the peak limiter is being used.
SIG	Flashing green, indicates that a signal is present at the output, that is, the signal exceeds a certain threshold. This threshold is fixed, currently, but will be user configurable in the future.
MUT	Steady red, indicates the the output was muted by the user

The status widgets can be moved freely in the status monitor by dragging them with the mouse. This comes in useful to represent the physical location of the devices on the screen.

Double-clicking a status widget establishes a TCP connection to the device.

6.3 Establishing a connection to the HD2

To establish a connection to a device, simply double click the corresponding row in the network monitor or double click the corresponding status window in the status monitor window.

If no entry is present, check the following:

Is the firmware version in the device 1077 or higher? If not, try clicking the [Network Scan](#) button and wait for about 3 seconds.

Is the device and the network properly configured? (See also chapter 5.1.3).

Is the device properly connected to the network?

Is the device properly connected to the power supply?

A new window will appear to control the device. This window is very similar to the one from the previous version 1 of the HD2Control software. The software reads the complete configuration from the device and initializes the GUI which may take some seconds. The GUI, then, looks like this

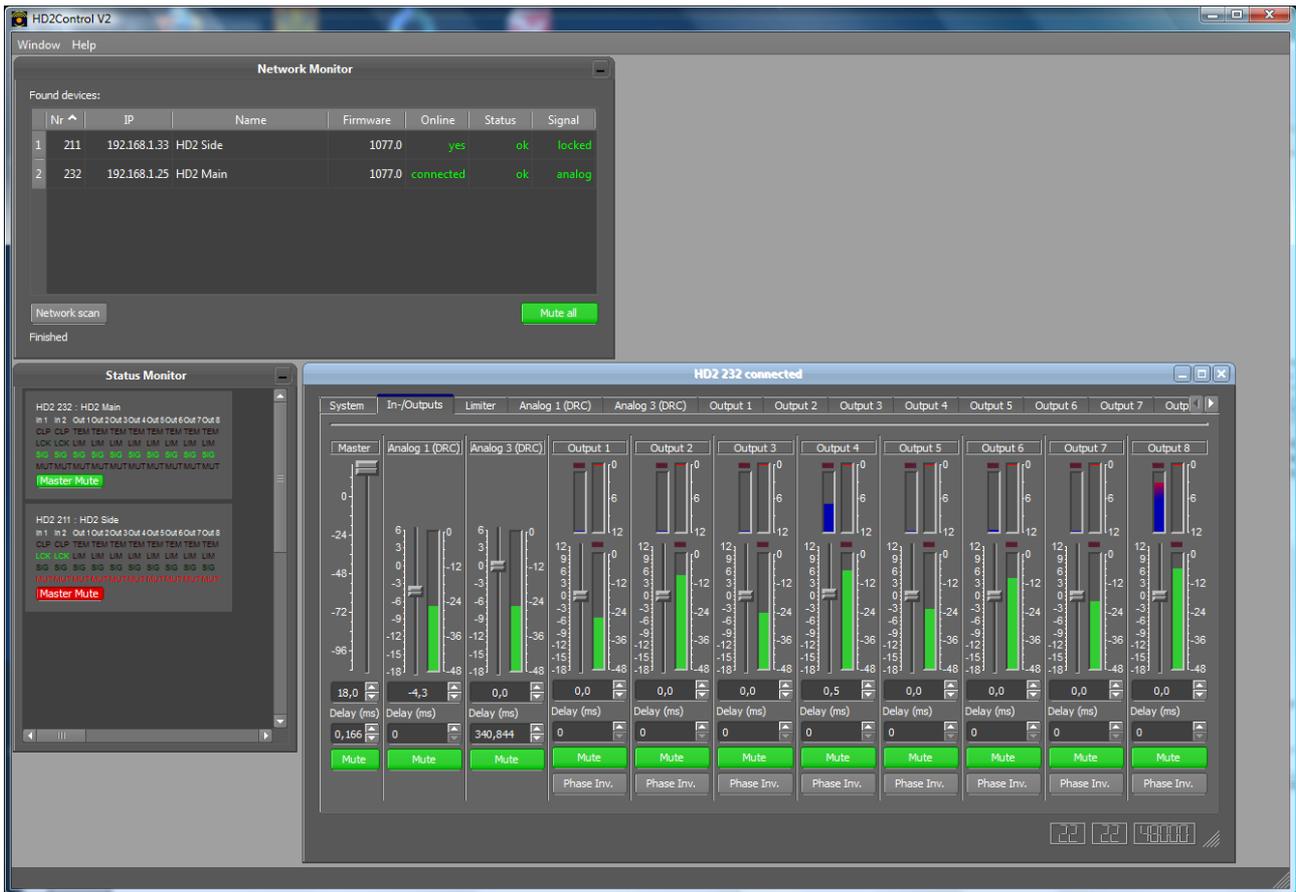


Fig. 8: HD2ControlV2 GUI after connection

For each HD2 in the network, a window can be opened. The windows can be freely arranged in the mainframe. Closing a window disconnects from the corresponding HD2. The position of each window is saved and restored again when reconnecting or restarting the software.

6.4 Basic Concept of Operation

The user interface for each HD2 is organized in several tabs. Each of these tabs is explained in detail below. A short overview follows here:

Tab	Functions
System	IP settings Routing Setup and filter management Storing and restoring the configuration to the hard disk. Restore factory settings Firmware update
In-/Outputs	Gain and delay settings for in- and output channels Level, gain reduction and coil temperature meters Channel mute and phase inversion
Limiter	Limiter configuration
In/Output Tabs	EQs (Peak, Shelving, Low-/Highpass) for in and output channels Filter (Butterworth/Linkwitz-Riley, etc. filters with slopes up to 60dB/oct.) Frequency/phase response plot of in-/output
Outputs	Frequency responses (amplitude and phase) of all outputs

6.4.1 Status Bar

Since software version 1075.4.1, a status bar appears at the bottom of the window. At the bottom right, a handle to change the size appears next to three numbers which display the processing power used by e.g. Eqs for each DSP and the sampling rate.

6.5 System Tab (simple mode)

In the system tab, you can manage the basic configuration of the HD2. It allows to change the setup and select different inputs. Also, you can manually disconnect from and reconnect to the HD2.

6.5.1 Selecting (Recalling) a Setup

The drop-down list labelled [Setup Select](#) contains a list of all setups present in the HD2. To recall a setup, click on the setup list. The drop-down list will open and you can click on the desired entry which will recall the setup. To cancel, simply press Esc or click on an area somewhere outside the list. Before switching to the desired setup, a confirmation dialog pops up.

Note: the master gain stored in the setup will not be restored by recalling it. That is, if your master gain is at -10 dB when recalling the setup, it will not be changed afterwards. If you shut off the HD2 and start again, it will come up with the gain value it had before shutting off.

6.5.2 Select Different Input

Based on the currently selected routing, different inputs can be selected. In most cases, three input options are available, namely Analog (DRC), Digital (SRC), and Digital (AES). There are, however, routing presets which do not allow all of these (e.g. routings which use 4 analog inputs). With the drop-down box, the user can quickly select the desired inputs.

6.6 Advanced Tab

If you check the [Show advanced options](#) checkbox in the System menu, an additional tab called Advanced appears in the task bar.

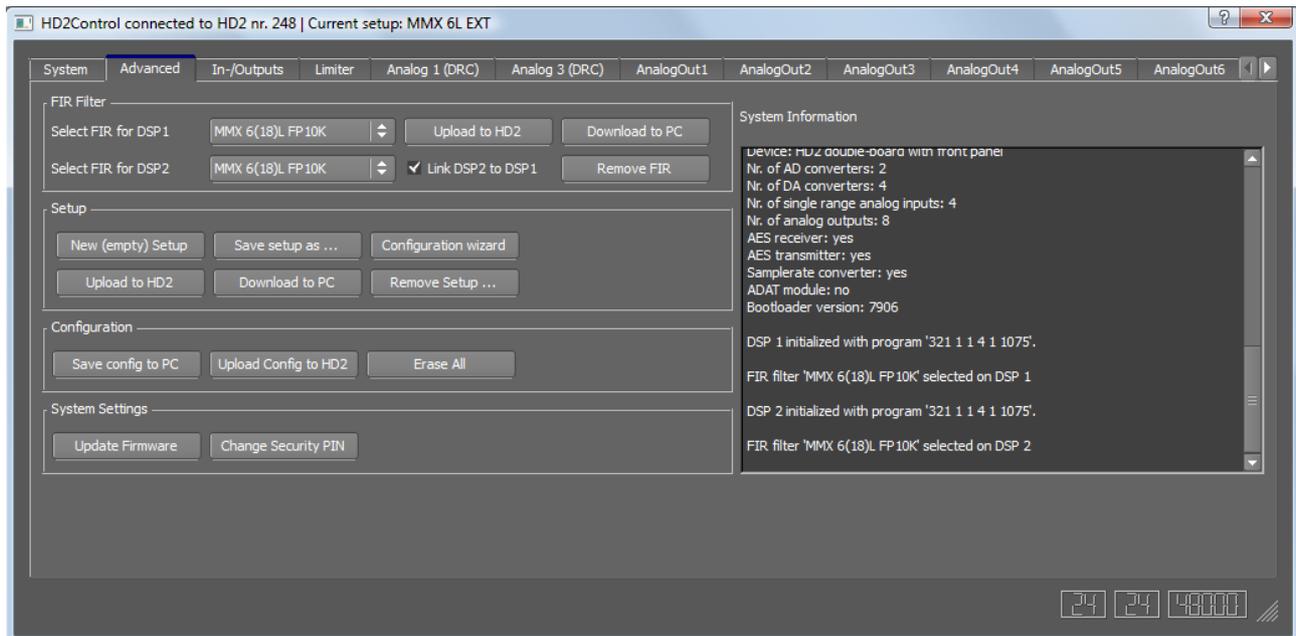


Fig. 9: Advanced options tab

6.6.1 FIR Filters

FIR filters contain filter coefficients for a maximum of 4 ways. Also, the limiter coefficients are stored in the FIR filter. The two DSPs in the HD2 provide 4 outputs each. DSP1 provides outputs 1-4, DSP outputs 5-8. Different FIR filters can be activated for each DSP. By linking the FIR filter settings, the filter for DSP1 is automatically selected for DSP2.

With the controls in the FIR Filter groupbox, FIR filters can be downloaded, uploaded and activated. After establishing the connection, the drop-down lists are filled with the filters present in the HD2. At the time of writing, the filters can only be generated with the software Monkey Forest. It generates two binary files named <filtername>.blk and <filtername>.fcs. The .fcs file contains information about the filter to be displayed in the GUI. As soon as a filter is uploaded to the HD2, it is newly formatted to reside in only 1 file with the suffix .fir. You can either upload the .blk file (if the corresponding .fcs file exists in the same directory) or upload a .fir file. The maximum number of FIR filters in the HD2 is limited to 30. It may be limited to a lower number by the flash memory size in the HD2.

Activating a FIR Filter

Clicking on a drop-down list will open the list. Clicking on a list entry will activate the filter. It will take some time until the filter is activated since the coefficients have to be loaded from the flash memory of the HD2 to the DSP. During switching, the DSP outputs are muted. If the Link to DSP1 switch is active, the drop-down list for DSP2 is disabled and the selected filter is automatically set on both DSPs. Activating the switch transfers the filter which is set in DSP1 to DSP2 automatically.

Uploading a FIR Filter

Clicking the [Upload to HD2](#) button opens a file select dialog. Navigate to the desired directory and select the filter to be uploaded. As mentioned above, you can select a .blk file if the corresponding .fcs resides in the same directory or a .fir file. After uploading the filter, it appears in the drop-down list and can be activated.

Downloading a FIR Filter

Clicking the [Download to PC](#) button in the FIR filter group box opens a small filter selection dialog. After the desired filter has been selected, a directory selection dialog comes up. The selected filter is, then, stored as a file with the extension 'fir' in the selected directory. The file name is automatically derived from the display name.

6.6.2 Setups

A setup contains the complete state information of the HD2. All settings like gains, delays, IIR filter, mutes, phase inversions, etc. as well as the FIR filter are stored inside a setup file on hard disk. The extension of setup files is 'hd2'. At the time of writing, a maximum of 30 setups can be stored inside the flash memory of the HD2. Depending on the number of FIR filters present in the flash memory, the number of allowed setups may be limited by the flash memory size.

Unlike FIR filters, setups have a fixed position, that is, you can store a setup at a certain location.

When a modification to the HD2 is made after a setup has been recalled, this setup is marked as modified by an asterisk (*) behind the setup name in the [Activate Setup](#) drop-down box. If the user tries to recall a different setup, a warning pops up that the current setup has been modified and must be saved to avoid loss of the recently made settings.

Creating a new (default) setup

For making a new setup from scratch, a "blank sheet" has to be restored to work upon. This can be done by clicking the [New \(empty\) Setup](#) button. The HD2 will, then, be loaded with default parameters but no setup or filter is stored or changed. After the user has made the desired settings, a setup can be stored as usual.

Storing / Creating a Setup in the HD2

After all settings are made in the HD2, the current state can be stored. For that, click the [Save Setup as ...](#) button which opens a dialog with a drop-down box where you can select the position, the setup shall be stored to. Enter a desired name and click the [Create setup](#) button. After a successful operation, the setup lists are updated. If a non-empty entry is selected, a warning pops up, that the setup stored at that position is about to be overwritten.

Downloading a Setup

A setup can be downloaded to hard disk for archiving or uploading it to another HD2. Clicking on the [Download to PC](#) button opens a dialog with a drop-down list which allows to select the setup to be downloaded. After the desired setup has been selected by [Select Setup](#), the directory to store the setup to can be selected. The filename is derived from the display name and the extension is 'hd2'.

Uploading a Setup

A setup which was stored to the hard disk can be uploaded easily. Clicking the [Upload to HD2](#) button opens a dialog where you can either enter the name of the setup file directly or click [Browse](#) to search for it in a file selection dialog. Select a position to upload to. Selecting a non empty list entry will overwrite the setup at that position.

After successful uploading, the setup list in the system tab is refreshed.

6.6.3 Configuration Wizard

In the Advanced tab, you find a button labelled [Configuration Wizard](#). After clicking the button, you can select the type of crossover filters, a routing, multipath options and the clock. At any step in the wizard, you can [Cancel](#), make a step [Back](#) or proceed to the [Next](#) one. The entered data will be sent to the

HD2 only after submitting by clicking **Finish** on the last page.

After the introduction screen (not shown), the following dialog comes up:

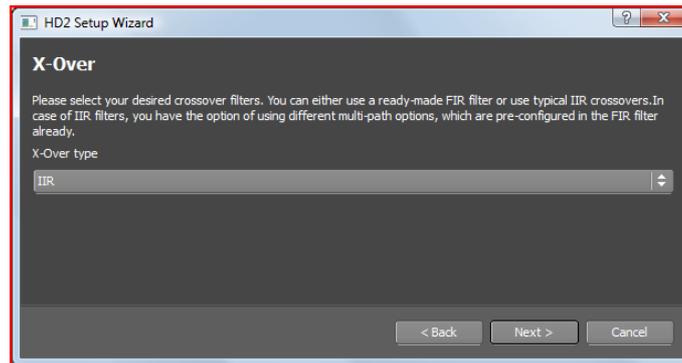


Fig. 10: X-Over dialog

Please select the type of crossover filters. If you want to use IIR filters, then, there's nothing more to do here. When you select FIR filters, additional controls show up:

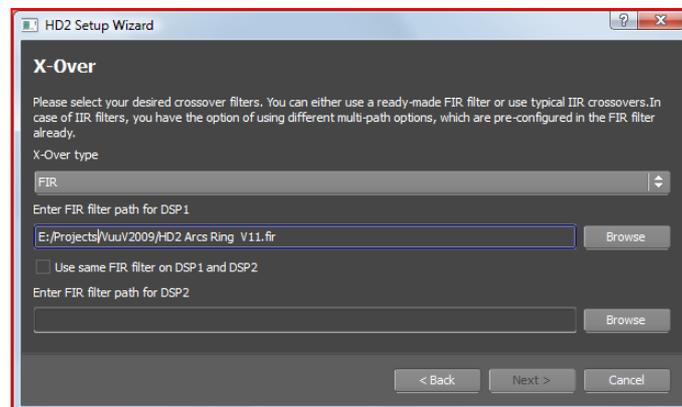


Fig. 11: X-Over dialog with FIR filters

You have to select 2 FIR filter files (or only 1 and select **Use same FIR filter on DSP1 and DSP2**). The sampling rates of the 2 selected filters have to be the same. If the settings are correct, the **Next** button is highlighted. After finishing the wizard, the 2 files will be uploaded to the HD2.

You can either choose FIR files from the file system with the **Browse** button, enter the filename directly, or, if there are already FIR filters present on the HD2, use the drop-down list to select one of those.

After the crossovers have been selected, the Routing page comes up:

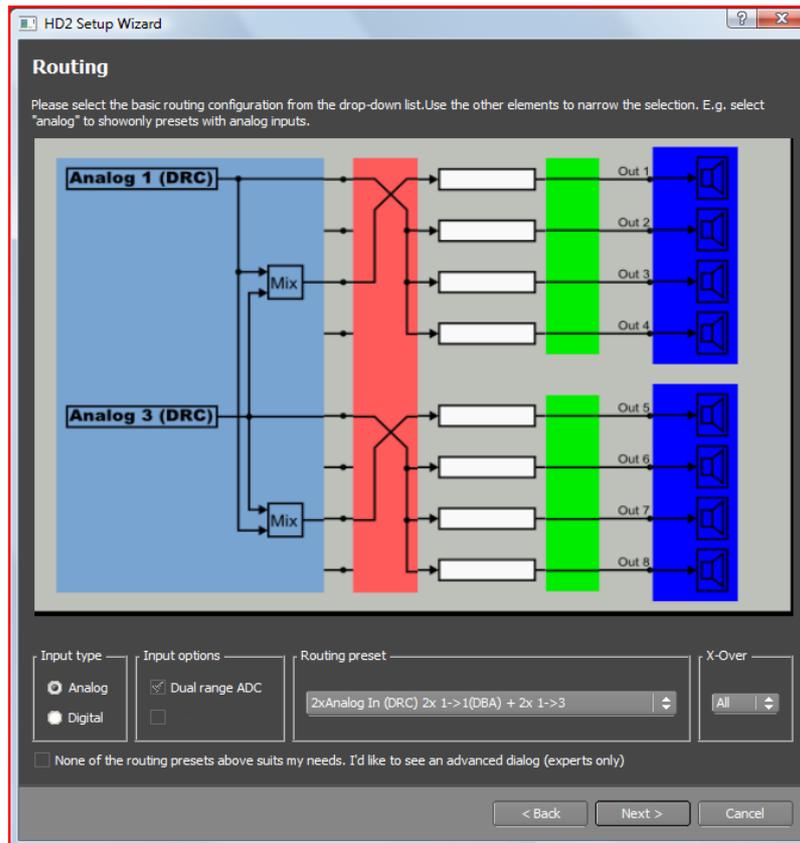


Fig. 12: Routing page in the Config Wizard

A routing can be selected from the drop-down box. The figure will be updated according to the selection. There are more than 30 routings available. To reduce the number of reasonable routings a bit, the filters left and right of the drop-down box can be used. Selecting an **Input type** 'Analog', e.g. removes all routings which do not use the analog inputs. Selecting the check box 'Dual range ADC' (DRC) further removes all entries which do not use DRC. Additionally, a filter can be set on the output routing in the **X-Over** drop-down box. E.g. selecting '1->4' shows only routings which support 1->4 crossovers.

Note: when FIR filters are selected, routing presets that do not fit to the filter settings are not shown.

After clicking **Next**¹, the following dialog comes up:

1 If you check the check-box below the filters ("None of the routing presets above suits my needs. ...") and click the Next button, an expert mode routing configuration dialog comes up, where the input and output part can be selected independently. Since this is only for advanced users, it is not explained here. Contact Four Audio for more information.

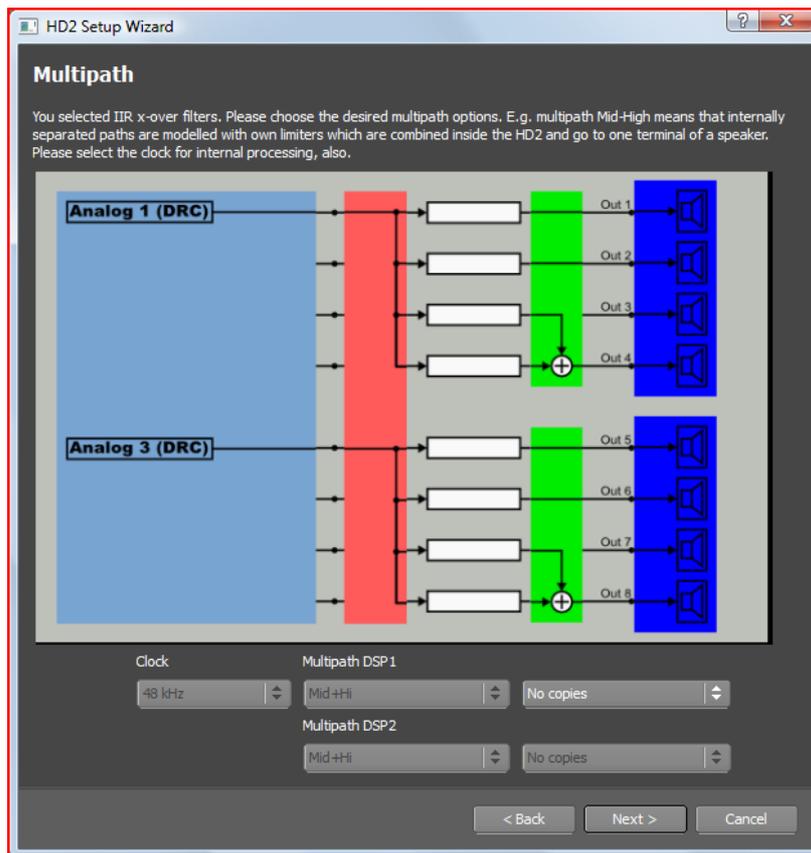


Fig. 13: Multipath and clock options in the config wizard

In the left drop-down box, the internal clock, the HD2 operates on, can be selected. If you chose to use FIR filters in the first dialog.

The multipath options allow to combine several output paths internally and feed, e.g. a speaker with a passive crossover inside. That is, the speaker is internally treated as a 2 or 3-way speaker (limiters, filters can be set as for a 2 or 3 way system). The signals at the outputs are, then, added up and fed to a full-range speaker.

Note: FIR filters provide values for clock and multipath. If you selected FIR filters in the X-Over dialog, the controls automatically show these values and are disabled.

When you click next, the last page appears (not shown here) and with the **Finish** button, the settings are transferred to the HD2.

Stereo filters inside a DSP

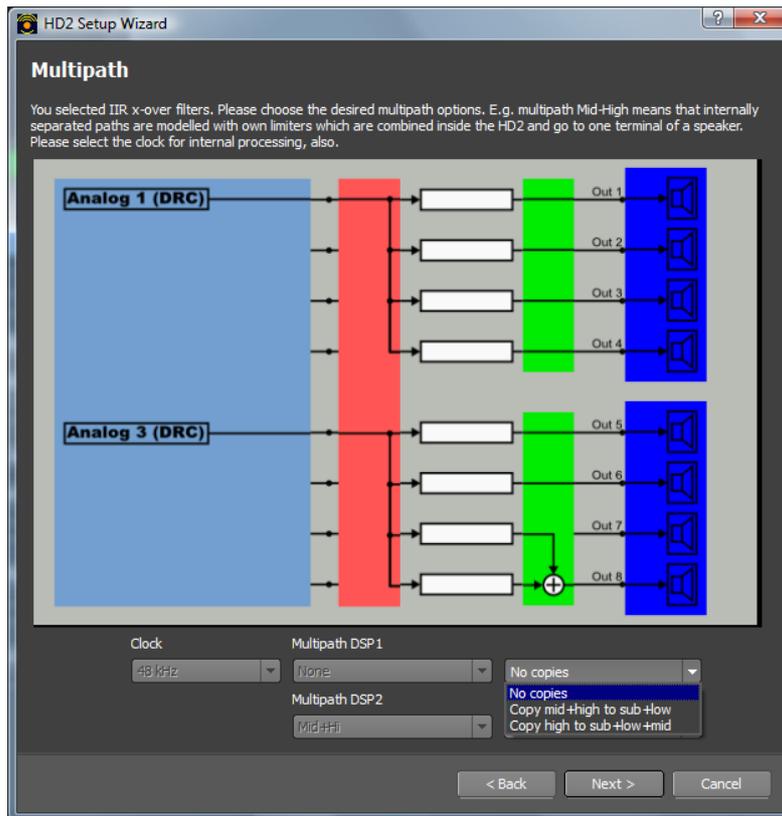


Fig. 14: Using a stereo setup inside a DSP

When using FIR filters, normally, the 4 outputs of one DSP are configured to feed sub, low, mid and high paths of a speaker. The HD2 allows to use a stereo mode inside one DSP, that is, it can feed mid and high 2 times or the coefficients for the high path 4 times. On a HD2 with 8 outputs, you can, then, feed 4 two-way speakers or 8 one-way speakers. To accomplish that, use a FIR filter with coefficients for mid and high path only (or high path only) and copy these to the other paths of one DSP. The wizard automatically detects this possibility from the selected filters and shows 2 additional drop-down lists as shown in the above picture. Additionally, it is possible, to copy the coefficients for the high path to all other.

If a 4x1->2 routing is selected, 4 two-way speakers can be fed from 4 different inputs.

If a 2x1->4 routing is selected, 4 broadband speakers can be fed from the same input.

Also, it is possible to feed 4 broadband speakers from 4 different inputs.

6.6.4 Firmware Update

Note: after updating the firmware, all data stored in the HD2 is lost. To prevent loss of data, store the HD2 configuration to hard disk by [Save Config](#) and upload it again after updating the firmware by [Load Config](#).

Note: the current software HD2Control requires at least firmware version 1071 to operate. You can connect to HD2s with older firmware versions and do firmware updates but should not expect that the software fully works with that version.

Upgrading the firmware of the HD2 to a newer version can be done via ethernet. You should have a valid firmware file named „hd2_v####.\$fwu“ where #### denotes the 4 digit main version number and \$ the sub-version number. The file size must be 122.144 bytes. To upgrade, simply push the [Update Firmware](#) button in the Configuration group box at the bottom and select the firmware file in the file selection dialog. The file will be transferred to the HD2 and copied internally. This takes about 45-50 seconds. After that, a reboot of the HD2 will occur and you should see the new version number

appearing in the display of the HD2.

The ethernet connection to the HD2 is getting lost during rebooting, as the user can see in the network monitor. The control window is closed, after the firmware update is complete. After a little time, the online status changes to **yes** again. A new connection can be established now, by double-clicking the corresponding row in the network monitor.

6.6.5 Erase Flash Mem / Reset to Factory Defaults

Pushing **Erase All** resets the HD2 to the factory default settings, that is, the flash memory is cleared, master gain is set to -40 dB and the internal DSP program (with no downsampling) and a Dirac impulse FIR filter is used.

6.6.6 Download / Upload the Complete Configuration

It is possible to download the complete configuration of the HD2 (setups, filters) to a directory and e.g. upload it to another HD2. Push the button **Save Config** in the Configuration group in the lower left corner. You will be asked for a directory to save the configuration into. Inside that directory, files named `set#_<setupname>.hd2`, and `<filtername>.fir` are stored. The # in the setup name refers to the position in the list visible in the GUI.

To upload the complete configuration, click **Upload Config** which will ask for the directory to upload from, scan the directory for valid files and upload them. The HD2 does not have to be empty for this operation. FIR filters different from the ones that are already present in the HD2 are appended. If an FIR filter already exists in the HD2, it will not be uploaded.

Setups behave differently since they are fixed to a certain position. If a setup file is named 'Set5_<setupname>.hd2' and a setup already exists in the HD2 at position 5, it will be overwritten. To prevent this, you can either upload the setups manually or rename the setup such that the number behind 'Set' is changed to the desired position.

6.6.7 Locking/disabling the front panel operation

To provide unauthorized use of the HD2 from the front panel, the keyboard can be locked with a 4-digit PIN that consists of numbers between 1 and 8. To lock the front panel, simply click the **Lock front panel** checkbox below the log window. If someone tries to operate the HD2 from the front panel, the display, then, shows "Keys locked - Enter Pin". To unlock from the software, simply click on the checkbox again. To unlock from the front panel, enter the 4-digit pin with the output keys labelled with 1 – 8. If successful, the display shows "Keys unlocked".

6.6.8 Change the 4 digit security PIN

By default, the 4-digit PIN is set to 1111. To change this, click on the **Change Security PIN** button. The following dialog comes up:

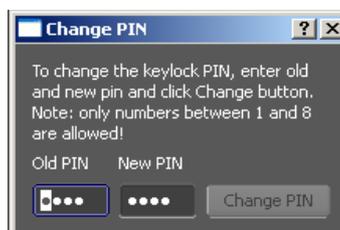


Fig. 15: Change Security PIN

Enter old and desired new PIN. **Note:** only numbers between 1 and 8 may be used. If valid numbers were entered, the Change PIN button is enabled. Click on it to transfer the PINs to the HD2. If the current PIN was entered correctly, the PIN is changed to the new one. In the status log, an appropriate

message shows up.

6.7 In-/Outputs Tab

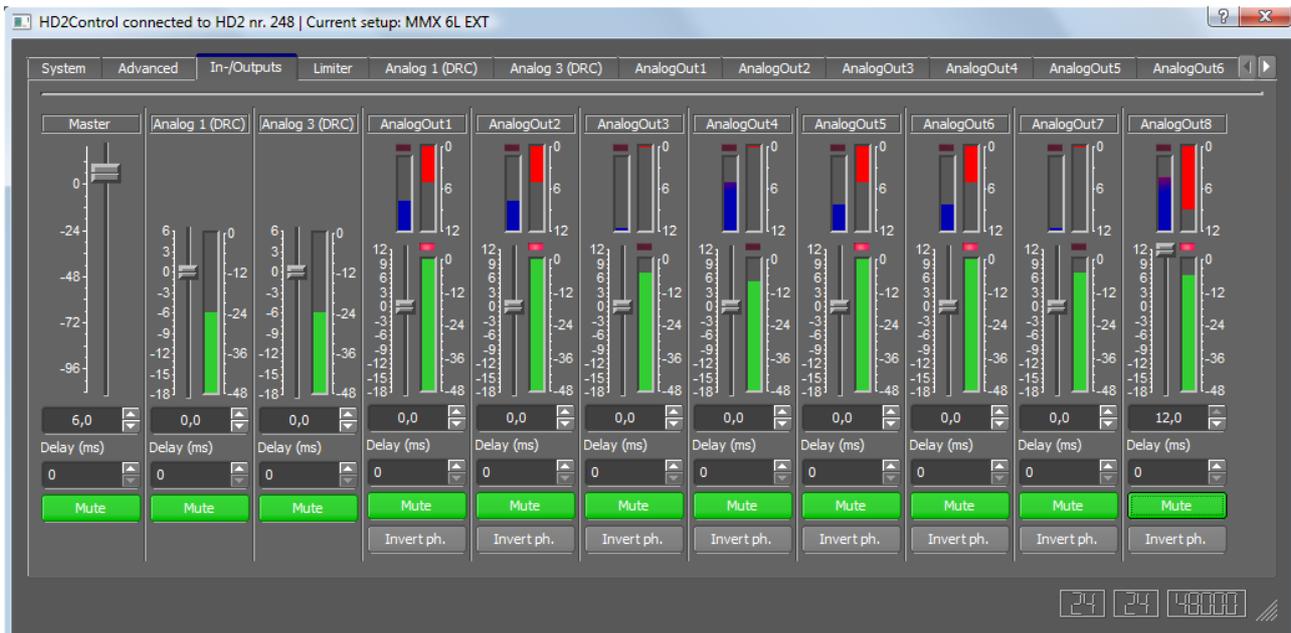


Fig. 16: In-/Output dialog with level, gain reduction and temperature meters

The gain tab contains indicators for input and output levels and gain reductions of the limiter as well as controls to set input and output gains, delays, mutes and phase inversions. Depending on the routing and configuration, the gain tab may look different than shown above. E.g. the names and numbers of the inputs may change. When more than 4 inputs are used, the gain tab is divided in two tabs. One of them shows only the inputs, the other one shows only output channels.

Indicators

Input level meters show the level in dBFS relative to the maximum input level (default is 28.5 dBu). The gain is not influenced by the input gain setting since these are placed behind the level meters.

Output level meters show the level in dBFS relative to the maximum output level (18 dBu)

Gain reduction meters (on top of the output level meters) show the gain reduction induced by both limiters. That is, if the level exceeds the peak limiter threshold by 4 dB, a gain reduction of 4 dB is shown. If the RMS or thermo limiter is active, the gain reduction of both limiters are added and shown here.

Speaker temperature is shown in the bar left to the gain reduction meters (blue bar, gets red on top). This is the percentage of the allowed maximum temperature as modelled by the thermo limiter based on the values entered in the limiter dialog.

Peak limiter LED (on top of the output level meters) show the activity of the peak limiter. It is activated when the output level exceeds the allowed threshold (0 dB at the meter), except when the thermo limiter is active. Then, the allowed threshold is reduced by the thermo limiter, that is, the peak limiter may get active without the output level reaching 0 dB in the meter.

Thermo limiter LED (on top of the temperature meter) shows the activity of the thermo limiter.

Setting Gains

The gains for inputs and outputs can be controlled with the sliders or by directly typing values in the corresponding edit fields below the sliders.

Setting Delays

The delays can be set by typing values in milliseconds into the edit fields or by clicking on the up/down buttons next to the fields. The step depends on the sampling rate, that is, for a sampling rate of 48000 Hz, the step is 1/48 millisecond.

Muting inputs and outputs

Output mute buttons en-/disable only the corresponding output. The button is coloured red or green for a muted or unmuted output.

Input mute buttons en-/disable the corresponding input causing the connected output to be silent. The input mute button turns red when muted. The mute buttons of the connected outputs turn light red and are disabled to indicate that no input signal arrives.

Master mute disables all inputs. Thus, all other mute buttons are disabled and coloured light red.



Fig. 17: Example: Outputs AnalogOut1 and 5 are muted. Input Analog 1 (DRC) is muted → the mute buttons for AnalogOut1-4 are disabled. At AnalogOut1, it can be seen, that both, the output itself and the corresponding input are muted.

Copying data between channels / HD2s

The parameters seen in this tab can easily be copied to another channel or HD2 by drag and drop. Click on the background in a channel and drag to another channel to copy. This can also be done between HD2s. For this, open 2 HD2 control windows, activate the In-Output tab in both windows and use drag and drop between these windows.

To copy all channel parameters including EQ and filter settings, press shift while performing the drag and drop operation. This will add all EQs and filters to the destination channel and overwrite gain, delay, mute and phase inversion settings.

6.8 Limiter Tab

In the limiter tab, you can edit the limiter settings for each output.

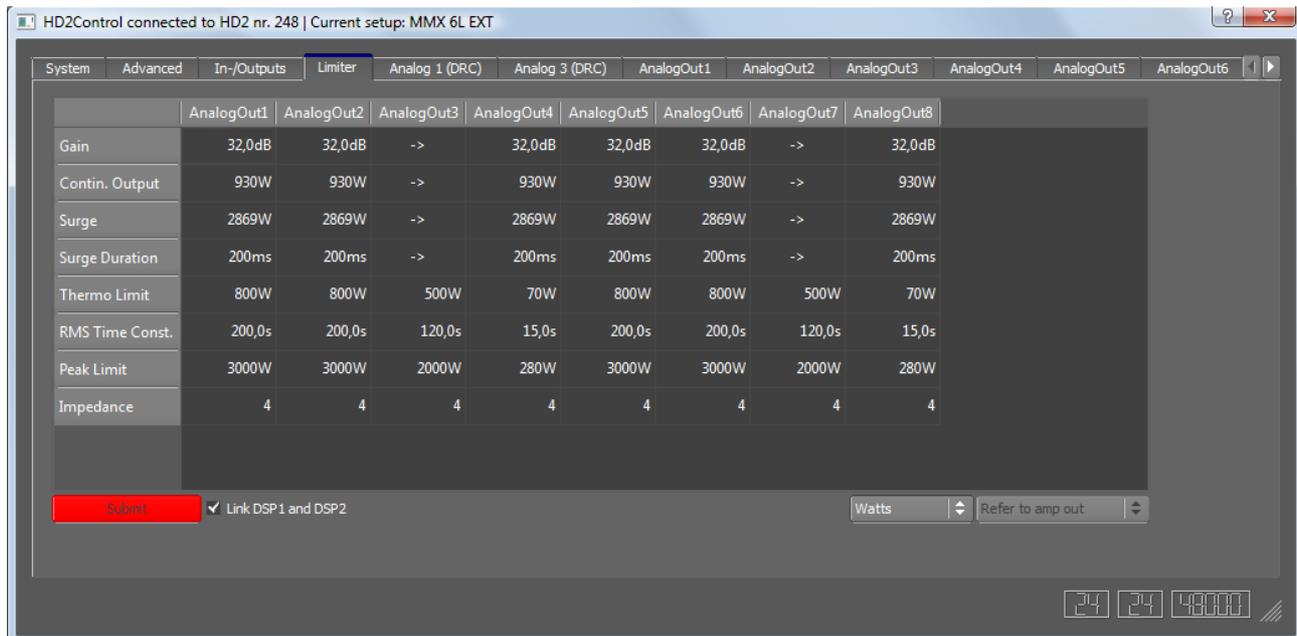


Fig. 18: Limiter settings

To edit the values, simply click on the cells. Some cells display left-arrows. This is due to either the use of multipath filters or copying of paths from higher to lower channels. The meaning is that the value in this cell is taken from the cell to the right.

Since version 1075.4.2, the dialog has changed. A new feature is the switch between different units (W, dB, dBu, V) and the reference to either the amplifier output or the HD2 output. The switches are located at the bottom right of the dialog. If dB, dBu or volts are used, the impedance of the speaker is used for calculations.

The values have the following meaning

Gain	Gain of the amplifier in dB
Contin. Output	Continuous output power of the amplifier in Watts (or different unit determined by the switch at the bottom right)
Surge	When the capacitors of the amps are full, more than the continuous output power can be drawn for a short time. This is the value above the cont. power that can be drawn.
Surge Duration	See above. Specifies the time in ms, in which more power can be drawn from the amp
Thermo limit	RMS power/voltage which causes the voice coil to be overheated and will activate the thermo limiter
RMS time const.	When thermo limiter is active and the output power goes below the Thermo limit, specifies the release time of the limiter
Peak limit	Output power in Watts which causes the peak limiter to get activated
Impedance	Loudspeaker impedance, necessary for limiter calculations

After a value has been changed in the edit field, it has to be sent to the HD2. You'll notice the submit button to be activated after a change.

If the user enters a limiter threshold which exceeds the maximum power or voltage, the corresponding cells turn yellow and a message pops up when the cursor is hovered over these cells. Example: with a loudspeaker impedance of 8 ohms and an amplifier gain of 32 dB, the maximum output power behind the amp is 7500W since the HD2 has a maximum output voltage of 18 dBu. If the user enters e.g. a value of 8000W for the continuous output power, this can never be reached.

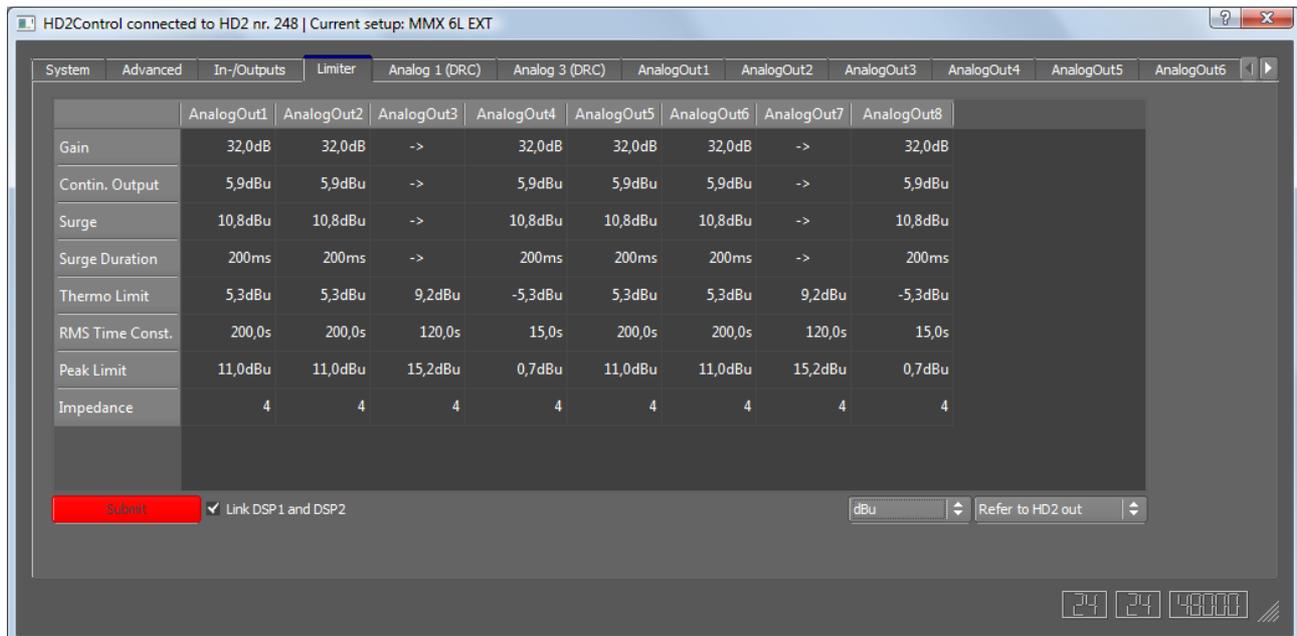


Fig. 19: Limiter dialog (as above) with values in dBu referred to the HD2 output

6.9 Input and Output Tabs

The processing inside the HD2 for a 1input -> 4 output routing is as follows:

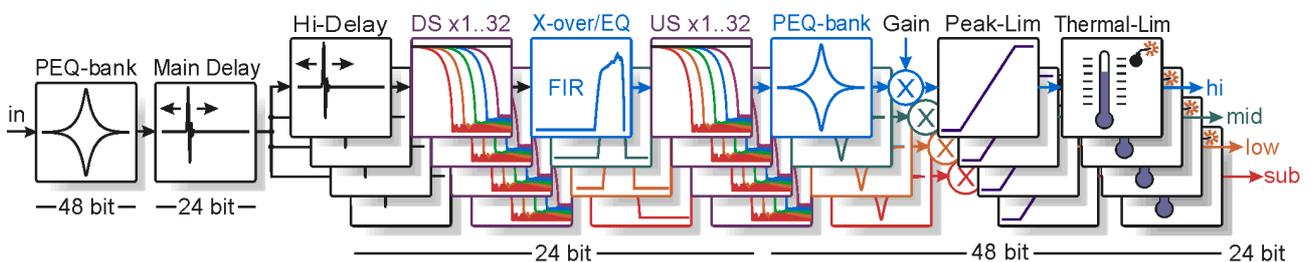


Fig. 20: Processing inside one DSP

EQs and filters can be set in the input path and in all output paths. Depending on the routing, on the use of dual or single range AD converters, etc. different numbers of in- and output paths can occur. The above picture shows the processing when using FIR filters as crossover filters. In case of IIR equalization and crossover filters, the blocks DS, X-over/EQ and US, that is downsamplers, crossover FIR filters and upsamplers, are non-functional. Instead the IIR filters (crossovers as well as EQ) are set in the PEQ-bank elements.

You can set EQs in the input/output tabs which look as follows

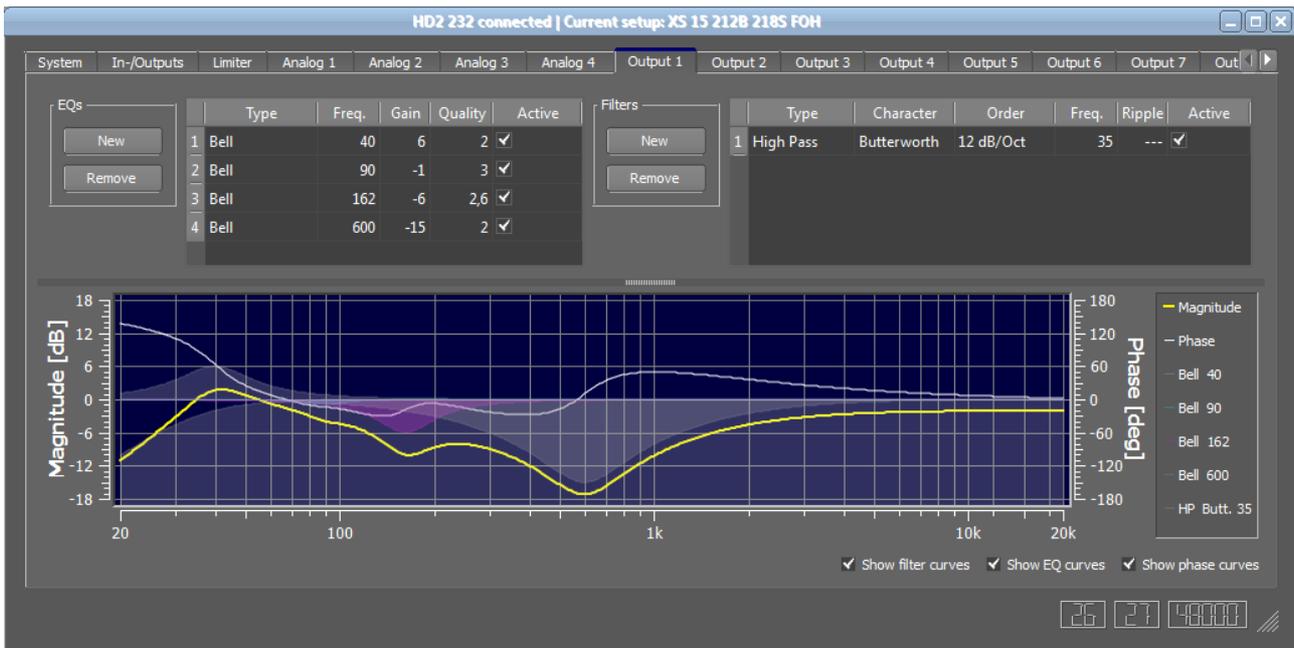


Fig. 21: The input / output tabs allow to set EQs/filters and show magnitude and phase of the corresponding channel and filter amplitude responses as shaded areas

If you use an IIR equalization, place the IIR filters in the output paths.

You can see the frequency and phase responses of the path in the blue plot. To illustrate the contribution of the filters, these are made visible by shaded areas.

The phase curve as well as the shaded areas can be turned on or off using the checkboxes below the plot or individually by clicking on the entries in the legend.

Note: If a filter is set in an input path, the frequency response will influence a corresponding output path as well. That means, even if no filter is set in an output but in an input, you'll see the frequency response of the EQ/filter which was set in the input in the output as well.

Set an EQ/Filter

To set a new EQ / Filter, click on the **New** button in the corresponding group.

Afterwards, you can edit the values by clicking on them which will open a control. The filter has to be activated by clicking on the **Active** checkbox.

Remove an EQ/Filter

To remove one or more EQs/Filters, select them by clicking and dragging on the first column displaying the nrs. Clicking **Remove** afterwards removes all selected Eqs/Filters.

Copying Eqs/Filters between Channels

To duplicate Eqs/Filters, select the desired filters by clicking on the numbers at the beginning of a row or right click and choose "Select all", then right click and choose "Copy". Go to the channel where you want to copy the Eqs/filters to, right click in the corresponding box and choose "Insert".

This also works between HD2s.

Another way to copy channel data is to use drag and drop in the In-/Output tab, see chapter 6.7.

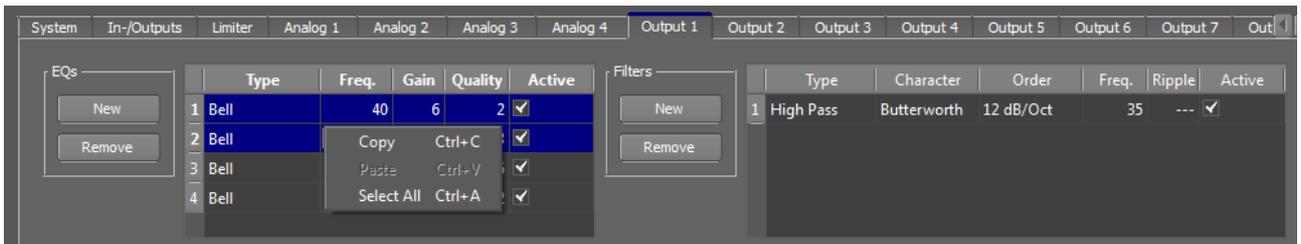


Fig. 22: Select and copy/paste filters using the context menu (right mouse button)