Notes on the Hauptwerk 5 Multi-channel Audio Output

These notes assumes you have read **both** chapters in the Hauptwerk 5.0 manual on audio routing.

The "presets"
The HW 5 audio system has 8 "mixer presets" which provides 8 audio "setups" (for each of the four Hauptwerk configurations Hauptwerk, Hauptwerk (Alt config 1), etc.). When an organ is loaded you can select which audio setup to use (which "**preset**"). This can be changed without re-caching the virtual sample set. You can use the large floating control panel *Audio Mixer, Routing and Voicing panning settings* to select a different "preset" and to access the audio routing controls.

Each "preset" provides 8 Master Mix buses, 8 Intermediate buses, 1024 Primary buses and 1024 Mixer Bus Groups.

Four output paths per rank…
HW 5 provides four output paths from each virtual rank and each of these can be connected to an output network which reproduces sound (such as a speaker or headphones). The same sound (from the same wave sample) is sent to each of the four output paths.

With all four outputs connected to "speakers" which are suitably arranged in the listening space, it is possible by adjusting the amplitude (and possibly other attributes) of each of these four outputs for the rank, through the *Ranks voicing and surround/3D perspective* screen, to position the virtual rank within the space (*panning* the apparent position of the sound).

NB. This is not the same as using a "surround sound sample set". In "surround sound sample sets" there are separate samples (virtual ranks) for the front and rear listening positions which are used to create the surround sound experience and usually the sample set includes controls to adjust the balance of the front and rear samples to optimise the listening experience. HW 5 provides each of the virtual ranks, for example each of the front and rear virtual ranks of a stop in a "surround sound sample set", with the four output paths – in this case four for the front sample and four for the rear sample.

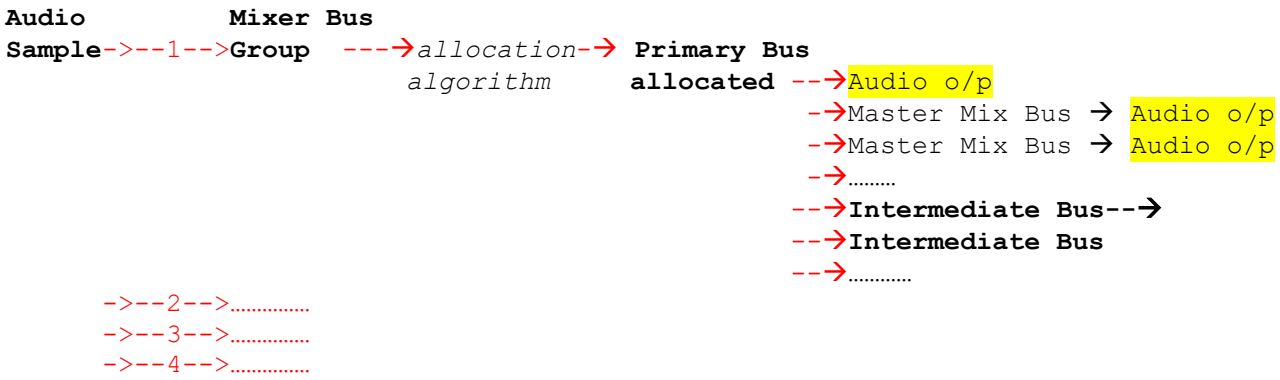
The HW 5 documentation discusses these four output paths in terms of four output perspectives: 1 (front 1 / main), 2 (front 2 / upper), 3 (rear 1 / main) and 4 (rear 2 / upper) and these titles are used as default names throughout the audio system. Whilst these are only names and do not (through these names) influence the operation of the audio system, some of the defaults in the audio system are set to support this perspective model. (You can reset the audio system to its defaults using the General Configuration wizard (take care only to reset the audio system settings and not the other settings). [I understand that in future some sample sets could be delivered with these four perspectives included within the sample set in a way which might automate the connection of samples to these output routes.]

It is not necessary to "connect" each of the four outputs; however at least one needs to be connected to a path leading to a "speaker" if sound is to be heard from the virtual rank.

There are separate voicing controls for each of the four outputs of a virtual rank, and for some of the parameters there is a control which affects all four outputs ("all perspectives").

For simple stereo output you only need to "connect" one of the output paths of a rank. For a "surround sound" sample set (where the supplier has provided distinct samples for the perspectives (for example *front* and *rear* samples), you also only need "connect" one of the output paths of each of the virtual ranks (for example one for the front and one for the rear ranks).

The audio output flow



When a note in a rank is to sound, a sample (wav file) is "replayed" in the depths of the audio engine.
*For **each** of the four output paths (for that note)*

HW 5 uses the configured mixer bus group for the rank to determine the primary bus to be used. The allocation algorithm configured is used to determine to which primary bus in the group the sound is "sent".

The targeted primary bus receives the sound and "sends" it to the audio device configured for that primary bus (if any) and sends it on to any other buses (Master Mix, or Intermediate bus) configured to receive sounds sent by that primary bus.

A primary bus can be configured to insert reverberation into the sound before it is "sent" on to the next stage.

If the sound is "sent" to a Master Mix bus, the Master Mix bus can send the sound on to be recorded (if so configured) or to a configured audio output device.

Master Mix buses can also insert reverberation if so configured.

Buses may be "sent" sound from multiple sources; sounds received at the same time are added together by the bus.

The buses have controls to adjust the level (amplitude) of the sound they "send".

Audio devices
HW 5's audio device screen lists the available output audio devices presented by the audio interface (through the operating system). You can name the devices on that screen, which can be helpful!

Audio Mixer
HW 5 has an audio mixer screen which is a key part of audio system.

Mixer buses, take inputs and pass them on to outputs, sometimes adjusting the sound as it passes through, merging (adding) inputs together before sending them out, inserting effects (such as reverberation): they usually have controls to adjust the level (amplitude) of the output etc.

The audio mixer has three types of mixer buses. Note the Mixer buses are stereo.

Master Mix buses which can:

- Send output to an audio output device
- Send output to a recording stream (used by HW 5's audio recorder)
- Insert impulse reverberation into the input before sending it to the output. HW 5 allows the user to select an impulse reverberation effect which is applied to the output of a Master Mix Bus.
- (They can't send to other Master Mix buses or to Intermediate Buses – although they appear on the screen they are "greyed out".)

Primary buses which can

- Send output to an audio output device
- Send output to a Master Mix Bus
- Send output to an Intermediate mix bus
- Insert impulse reverberation into the output. HW 5 allows the user to select an impulse reverberation effect which is applied to the output of a Primary Bus.

Intermediate buses which can

- Send output to an audio output device
- Send output to a Master Mix Bus
- (They can't send to Intermediate Buses – although they appear on the screen they are "greyed out".)
- Insert impulse reverberation into the input before sending it to the output. HW 5 allows the user to select an impulse reverberation effect which is applied to the output of an Intermediate Bus.

Intermediate buses provide a convenient way of gathering sound together, process it and send on to a number of Master Mix buses.

Mixer Bus Groups

A *mixer bus group* gathers together a collection of one or more *primary* buses. There is a screen, Audio Mixer Bus Groups, for setting these up. A primary bus may be a member of any number of mixer bus groups.

Rank routing

HW 5 uses a screen, *Rank Routing to Audio Mixer Bus Groups,* to assign each of the four outputs for a rank to a *mixer bus group*. HW 5 allows the allocation algorithm to be selected (also on this screen) for each output and uses the algorithm chosen to allocate the sound for that output amongst the primary buses in the assigned mixer bus group. Rank outputs which are not being used are assigned to a mixer bus group containing no primary buses.

Tail truncation (in real time)

The *Ranks voicing and surround/3D perspective screen* can be used to truncate the release tail of a rank. This does not reduce the memory requirements when loading the samples; it takes place in real time.

Impulse Reverberation

When reverberation is added by a bus the output from the reverberation includes some of the original incoming (dry) sound: this might be noticeable on the reverb output when the reverb wetness its set to 0%.

Audio recorder level

Set from the Master Mix bus being recorded. This is not independent of the "overall audio volume control".

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