HAUPTWERK

VIRTUAL PIPE ORGAN

User Manual

Version 3.30

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Section I: About Hauptwerk

Hauptwerk is a computer program that takes full advantage of the enormous processing power of the latest home computers to provide very complex pipe organ modeling and per-pipe sound shaping, while maintaining the enormous polyphony necessary to model a pipe organ successfully.

At its core, Hauptwerk is a very powerful and high-performance specialist software sampler.

The system is built around the philosophy of using at least one large sample per pipe (typically 3-10 seconds), all including release samples to record the decay of each pipe accurately, and recorded in CD quality or better. All samples are held in memory to achieve a much higher polyphony for a given hardware cost than is possible with disk-streaming, commonly used in software samplers. Unlike generic software or hardware samplers, Hauptwerk has complex physical and acoustic models specifically designed to reproduce the features and sound of a pipe organ, and is thus able to achieve much more realistic results. It is also designed for a much higher polyphony than generic samplers.

But Hauptwerk is much more than a sampler. It also models all of the physical controls and functional details of a pipe organ. The main console screen shows you a photo-realistic representation of the console, and allows you full control over the virtual organ in the same way that you would control the original instrument. Everything behaves as you would expect; stops, couplers, the programmable combination system, swell pedals, crescendo pedals, ventils, theatre organ second-touch, bass and melody couplers, and so on. You can also use up to four touch-screen monitors to make the virtual controls accessible in convenient locations relative to your MIDI console or MIDI keyboards. *(1)*

What's more, in Hauptwerk every control and function can be fully controlled by MIDI, and Hauptwerk can send MIDI output to control moving/illuminated draw-knobs/tabs, control real external ranks of pipes or hardware expanders, and even control LCD panels to show labels for each draw-knob and piston. If you wish, Hauptwerk can be fully integrated into a MIDI organ console and operate as its 'engine', with comprehensive real-time per-pipe voicing facilities, multi-channel audio output and all of the features you would need from a high-end system. *(1)*

But perhaps the biggest appeal to many of Hauptwerk's users is that you are not restricted to a single set of organ sounds. Have a look at some of the amazing sample sets available for Hauptwerk, listed on the Hauptwerk website. Some of the greatest organs in the world can be played virtually.

Hauptwerk is available for Apple Macs (both Intel and PowerPC Macs) as well as PCs running Windows. If you are a Windows studio user, Hauptwerk can also run as VSTi plug-in, enabling it to be integrated conveniently within Cubase and other major VSTi hosts, or used with virtual MIDI cable drivers with non-VSTi sequencers. Currently the (VSTi) plug-in version of Hauptwerk is only available on Windows platforms, but a plug-in version is planned for the Mac platform soon.

Because Hauptwerk is designed to give incredible performance and realism, a fairly modern, powerful computer will give best results. We think that's a small price to pay for the results you will get.

However, you can still use Hauptwerk on older computers with excellent results and a huge polyphony by simply disabling some of the audio realism features such as interpolation and per-pipe filters. Even with only 512 MB of memory you can still use Hauptwerk very effectively with smaller sample sets, or by choosing to load only certain ranks of larger sample sets. Unless you are buying a pre-configured Hauptwerk-based system, it also helps if you have some basic experience with computers and MIDI.

(1) MIDI output, real-time voicing, the LCD panel system, multi-channel audio output and multi-monitor support are only available in the Advanced Edition of Hauptwerk.

Who uses Hauptwerk and why?

We are fortunate to have a large and enthusiastic community of users who have supported Hauptwerk since the launch of version 1 in 2002. You can read about some of Hauptwerk's users on the Hauptwerk website forum by visiting http://forum.hauptwerk.com/.

There are also plenty of third-parties who produce many diverse and wonderful sample sets in Hauptwerk format, listed on the Hauptwerk website, ranging from famous historic baroque organs to romantic giants to theatre organs, harmoniums and even harpsichords.

Hauptwerk is most often used:

- For study and practice at home by organists, organ enthusiasts and music students.
- In churches, theatres and concert halls to power digital organs and voice expanders.
- In commercial and home recording studios to provide the ultimate pipe organ sound.
- For music composition and arrangement.
- For historical organ and music study and research.
- For making playable documentary recordings of endangered or valuable pipe organs.
- As an instrument on which to learn the organ in schools, music colleges, etc.
- To upgrade old digital/electronic organs to the latest audio technology and realism.

We aim to bring the pipe organ, king of instruments, to as many people as we can with the highest degree of realism possible on current home computer hardware.

However, we believe that, no matter how realistic or advanced, no model or imitation can ever equal a real pipe organ. We sincerely hope that Hauptwerk should never replace, or be considered as an alternative to, a real organ if space and finances permit.

Licensing and editions

Hauptwerk is commercial software, and you must normally buy a separate license for each computer on which it will run simultaneously. Licenses can be purchased through the Hauptwerk on-line shop. A license takes the form of a Hauptwerk USB key (a 'USB dongle' in computer terminology), allowing Hauptwerk to function as a full licensed version when connected to the computer.

You can also download the full Hauptwerk software or order it on DVD from our website.

The software can be used in evaluation mode, which allows the full functionality of Hauptwerk (either Advanced Edition or Basic Edition) to be tested. However, the license agreement only allows evaluation versions to be used for the purpose of evaluating Hauptwerk (and only for a reasonable evaluation period), and a periodic triangle is audible in evaluation mode.

By purchasing a license for Hauptwerk you will be supplied with a Hauptwerk USB key. Simply connect the USB key to a spare USB port on your computer to turn your evaluation installation into a full, licensed copy, removing the triangle chime. Your settings will not be lost in the process and there is no need to re-install.

If you have a license for the smaller Basic Edition (previously named Studio Edition) and you want to evaluate features in the full Advanced Edition (previously known as the Concert Edition), simply exit Hauptwerk and disconnect your Hauptwerk USB key temporarily (never attach or detach the USB key while Hauptwerk is actually running). When you launch Hauptwerk again it will allow to you to run it as an evaluation version, allowing you to try out the functionality of the Advanced Edition. Reconnecting your USB key will return you to your licensed Basic Edition. No settings will be lost in the process.

You may move a Hauptwerk license between as many computers as you wish (Mac or PC), or use it with multiple disk partitions, but you may only have one computer per license actually running Hauptwerk at any given moment, with the Hauptwerk USB key attached to that computer. In particular, the USB key is not hardware-specific, so you can change your computer hardware as many times as you wish, or re-install your computer as many times as you wish, and your Hauptwerk license will still be valid and continue to work. This is the main reason that we think that a USB key is the fairest and simplest way to license software.

Hauptwerk's USB key is also used to license some third-party sample sets. As with the Hauptwerk license itself, these licenses are stored within the USB key and so the sample sets you have purchased will work on any computer, provided that your Hauptwerk USB key is attached to that computer at the time. If you buy such a sample set or you upgrade your Hauptwerk license, Milan Digital Audio or the vendor will contact you with instructions to allow us to update your Hauptwerk USB key remotely, which is a simple procedure that takes only a few moments. The USB key needs to be updated before you will be able to install or use the sample set. As with Hauptwerk's license, because the sample set licenses are stored inside the Hauptwerk USB key, there is no need to update the USB key again if you change any computer hardware or re-install.

Note that you need to be able to send a small file from your Hauptwerk computer, and to receive another small file back (each less than 10 KB) onto your Hauptwerk computer in order to update your Hauptwerk USB key. Usually these files are sent by email. However, if your Hauptwerk computer is not connected to the Internet, you can simply save them to a write-able CD, floppy disk or USB memory stick to transfer them between your Hauptwerk computer and another computer that has Internet access. Thus you do not need Internet access from your Hauptwerk computer.

Important: Please make sure that you do not lose the Hauptwerk USB key since we cannot normally replace it unless you pay for another license. If you break the USB key we will replace it for a small charge once we have received the original USB key back. Please also remember that we are a small company, and that Hauptwerk takes a great deal of time and money to develop and support, and ensure that you license Hauptwerk honestly.

If you are concerned about the possibility of losing the Hauptwerk USB key, software or sample sets, we would advise insuring them. Specialist musical equipment insurance policies will usually provide cover for audio hardware, software and sample sets.

Hauptwerk Free Edition

The Hauptwerk software can also be used in Free Edition mode. The Free Edition has all of the features of the Basic Edition except:

- Its polyphony is restricted to 256 simultaneous voices (pipes). That's sufficient for practicing with smaller organs with small/medium-sized acoustics.
- You can load a maximum of 1.5 GB of sample data into memory at a time. You can load larger sample sets, but you will need to disable some ranks.
- 24-bit or 32-bit sample sets will work fully, but can be loaded in a maximum of 16-bit resolution.
- Non-commercial, home personal use only.
- No support. You must buy a licensed edition if you need help or advice from us.
- You may use the Free Edition on only one computer at a time.
- You cannot use commercial sample sets if they are licensed via the Hauptwerk USB key (unless you have a license for them on an attached Hauptwerk USB key for an earlier Hauptwerk version).

We make the Free Edition available so that people who would genuinely not otherwise be able to afford a license can use Hauptwerk for learning and practice. If you can afford to buy a license, please support Hauptwerk's development by buying a license for it.

If you launch Hauptwerk from the stand-alone or MIDI sequencer icons with no Hauptwerk USB key attached, you will be asked whether you would like to use the Free Edition or to evaluate one of the licensed edition.

Because VST plug-ins cannot usually display options screens when they launch, to select the Free Edition for the VSTi version of Hauptwerk, open Hauptwerk (by default it will start in evaluation mode if no Hauptwerk USB key is found), go to the *General settings | General options* screen and change the *Default unlicensed edition* preference there for which edition to use/evaluate, then unload and re-load the plug-in to re-start Hauptwerk. You will then be able to use/evaluate the edition you selected.

Section II: Installation

Hauptwerk prerequisites

This section lists the platforms and hardware supported for use with Hauptwerk. Please see also the computer specs website page if you are considering buying a new computer to run Hauptwerk and are looking for specific recommendations.

Computer platforms

The current version of Hauptwerk is supported on Apple Macs *(*)* (Intel and PowerPC) running Mac OS X, and on PCs running Windows.

If you are buying a new computer to run Hauptwerk, we particularly recommend the current (Intel) range of Apple Macs *(*)*, especially the Mac Pro, since we have found them to perform outstandingly well with Hauptwerk, to be very simple to set up and use, and also to be very reliable and robust for use with audio and MIDI in general, while being reasonably-priced for their performance. Above all, because there are only a few models of Macs, there are far less variables than with PCs, so you can be much more confident that you are buying a computer that corresponds very closely to one that we have used for testing, benchmarking and developing Hauptwerk, and should thus perform the same for you as it does for us. It also means that you shouldn't have to spend time ironing out compatibility, driver or performance problems.

However, we support Windows platforms equally, as we have since Hauptwerk's was first launched. Buying a PC that has been specifically built and tested by a specialist vendor for optimum Hauptwerk compatibility and performance can be an equally good choice.

(*) Important note: the current version of Hauptwerk for Mac OS X has the following two limitations compared to Windows platforms, which we plan to address in later versions soon:

1. *This version of the Hauptwerk installer currently only includes a 32-bit version of Hauptwerk for the Mac, thus a maximum of about 3.5 GB of RAM can be used for Hauptwerk and the sample set being loaded. Please see the Hauptwerk website to obtain a 64-bit version (which allows almost unlimited memory to be used).*
2. *There is not yet an AudioUnit/VST plug-in version of Hauptwerk for the Mac. However, Audio Hijack Pro can be used to apply reverb/convolver plug-ins very easily to Hauptwerk's audio output in real-time.*

Processors

On the Mac platform all Intel Macs are supported, as well as any of the older PowerPC Macs with G4 or G5 processors. The latest Macs are recommended for their extremely high performance with Hauptwerk, especially the Mac Pro and MacBook Pro ranges. To use 64-bit Hauptwerk for OS X you need a 64-bit capable Intel Mac (all Mac Pros and all Macs made after about November 2006 have 64-bit capability).

On the PC platform, Intel Pentium II and later processors are supported, along with compatible AMD models. The Intel i7, i5, 'Core 2' dual and quad-core ranges of processors, along with the corresponding 5100-series and later Xeon ranges, are strongly recommended since they perform so well with Hauptwerk. The AMD dual and quad-core models are also good, but the recent Intel processors out-perform them for Hauptwerk by a substantial margin at the time of writing. Hauptwerk has native support for 64-bit Windows on 64-bit processors (such as the Intel 'Core 2' and AMD Athlon 64 and Opteron ranges), which gives the highest performance on the PC platform.

Hauptwerk is also fully optimized for multi-core/multi-processor systems on both Macs and PCs. Very roughly speaking, the more CPU cores, the faster the processor and the more level 2 (L2) cache, the larger the number of pipes that will be able to sound at once in Hauptwerk.

Although fast modern processors enable very large sample sets to be used, they are not requirements, and even a PC with a 1 GHz Pentium III processor will give perfectly sufficient performance for many smaller instruments with all of Hauptwerk's features enabled, or larger instruments if some realism features are disabled (such as interpolation and per-pipe filters).

Memory

An absolute minimum of 512 MB of memory is required to use Hauptwerk, and sufficient free memory is required to load any sample sets you intend to use into memory; Hauptwerk deliberately does not stream samples from disk in order to achieve the high polyphony necessary for a pipe organ. Most sample sets state the memory they require as a prerequisite. In order to be able to use a reasonable selection of sample sets, 2 GB or more of memory is recommended. If you are buying a new computer specifically to run Hauptwerk, we would normally recommend 4 GB or 8 GB if the computer can accept it, which would be sufficient for most current sample sets.

Note that you can choose to load only some ranks of pipes into memory. Other per-rank memory-saving options are also available.

Hard disks

An absolute minimum of 4 GB of free disk space is required to use Hauptwerk with the standard St. Anne's, Moseley organ sample set installed by default. Other sample sets will require additional disk space. We recommend ensuring that you have at least 40-200 GB free if you wish to use a number of different sample sets.

The speed of your hard disk(s) only determines the time it will take Hauptwerk to load a sample set; the performance should not be affected once the sample set is loaded into memory. RAID 1 or RAID 5 disk arrays can be used if you want sample sets to load quickly and also to make your system more resilient to the failure of a hard disk.

If you are installing Apple Mac OS X from scratch (not usually required), we recommend using the default file system during installation, and avoiding the 'case sensitive' file system (a custom installation option) since some Hauptwerk sample sets may not be compatible with it. On Windows PCs we strongly recommend using the NTFS file system (the default for Windows 7, Vista and XP) instead of the older FAT32. FAT32 does not support files larger than 4 GB, which can cause problems for some very large sample sets.

Operating systems

On the Apple Mac platform, Hauptwerk is fully supported on OS X 10.6 'Snow Leopard' (versions 10.6.1 and above), OS X 10.5 'Leopard' (versions 10.5.8 and above) and 10.4 'Tiger' (versions 10.4.11 and above). Hauptwerk might not work on earlier versions and some earlier OS X versions had serious bugs that affected Hauptwerk. We recommend OS X 10.6 since 10.6 and 10.5 each had significant performance and stability improvements internally that are relevant to Hauptwerk and only 10.5+ can support 64-bit Hauptwerk. *(1)*

This version of the Hauptwerk installer only includes a 32-bit version of Hauptwerk for the Mac, thus a maximum of about 3.5 GB of RAM can be used for Hauptwerk and the sample set being loaded. Please see the Hauptwerk website to obtain a 64-bit version (which allows almost unlimited memory to be used).

OS X 10.6 and 10.5 each have simultaneous 64-bit and 32-bit support built natively into them. Unlike Windows, there are not separate 64-bit and 32-bit versions of OS X, and no separate 64-bit drivers are needed for 64-bit Hauptwerk if the default OS X installation and boot options are used. OS X 10.6 has a (non-default) boot option to boot the kernel in 64-bit

mode, which can optionally be used, but not all third-party hardware drivers are compatible with it, and it is not needed to run 64-bit Hauptwerk.

On the PC platform, Hauptwerk is fully supported on the following versions/editions of Microsoft Windows:

- Windows 7 Home Premium Edition (32-bit and 64-bit).
- Windows 7 Ultimate Edition (32-bit and 64-bit).
- Windows 7 Professional Edition (32-bit and 64-bit).
- Windows Vista Home Basic Edition (32-bit and 64-bit).
- Windows Vista Home Premium Edition (32-bit and 64-bit).
- Windows Vista Ultimate Edition (32-bit and 64-bit).
- Windows Vista Business Edition (32-bit and 64-bit).
- Windows XP Professional x64 Edition (64-bit).
- Windows XP Professional Edition (32-bit).
- Windows XP Home Edition (32-bit).

Effective memory limits for use with Hauptwerk are as follows:

- 64-bit Windows 7 Home Premium Edition: 16 GB.
- 64-bit Windows 7 Ultimate Edition: 192 GB.
- 64-bit Windows 7 Professional Edition: 192 GB.
- 64-bit Windows Vista Home Basic Edition: 8 GB.
- 64-bit Windows Vista Home Premium Edition: 16 GB.
- 64-bit Windows Ultimate Edition: 128+ GB.
- 64-bit Windows Business Edition: 128+ GB.
- 64-bit Windows XP Professional x64 Edition: 128+ GB.
- 32-bit versions of Windows 7, Vista and XP: about 2.7 GB, following modification to the Windows boot parameters, otherwise 2 GB *(2)*.

All editions of Windows 7, Vista and XP support multi-core processors. However, support for two separate physical processors is only included in Windows 7 Professional, Windows 7 Ultimate, Vista Business and Vista Ultimate editions and XP Professional editions. Earlier Windows versions might work with Hauptwerk, but have limitations and we do not test with them. If you wish to use such operating systems, we will endeavor to provide support provided that a problem can be reproduced on one of our fully supported platforms.

64-bit versions of Windows are strongly recommended for PCs that support them. Hauptwerk's installer includes a native optimized 64-bit edition of the Hauptwerk software, which is able to perform significantly better than the 32-bit editions, allowing larger sample sets to be used, and with better performance.

Please ensure that drivers are available for all of your hardware on the operating system you wish to use.

(1) The only notable disadvantage of OS X 10.6 and 10.5 is that they do not allow an application (such as Hauptwerk) to fill the memory as full as was possible with OS X 10.4 when 4 GB or less of physical memory is installed, so Hauptwerk might not be able to use quite as much memory on computers with 4 GB or less. OS X 10.6 and 10.5 typically allow Hauptwerk to use a maximum of about 65 percent of the physical memory before audio glitches become a risk (due to 'swapping').

(2) 32-bit editions of Windows normally only allow any one program to access up to 2 GB of memory. To enable Hauptwerk to use up to about 2.7 GB of memory on 32-bit Windows XP, the Windows boot.ini file (usually c:\boot.ini) must be modified manually, adding the /3GB /Userva=2900 switches in a text editor. On 32-bit Windows 7 or Vista the BCDEdit utility must be used to set the IncreaseUserVA value. Either should only be attempted by experienced computer users, since it is very easy to

render Windows unable to boot if any mistake is made. Microsoft Knowledge Base article 833721 describes the /3GB switch, and Microsoft Knowledge Base article 289022 explains how to modify the Windows boot.ini file in general. This Microsoft MSDN page also describes parameters for increasing the 2 GB per-application memory limit on XP and Vista. Any such modifications are attempted at your own risk.

Operating system patches

All current operating system updates and service packs should be applied when they are available. **Important**: Hauptwerk's installer might not work properly on Windows XP unless the latest version of DirectX is installed. You can check the version of DirectX by selecting *Start | Run* and typing *dxdiag*. You can download the latest version of the 'DirectX End-User Runtime' from Microsoft's downloads website. On Windows PCs, also make sure that the latest drivers are installed for your motherboard and graphics card and that the latest BIOS is installed for the motherboard.

Audio/sound interfaces

In principle, any audio or sound interface which is supported by the manufacturer on your operating system and hardware, and has good drivers should work. Mac OS X has high-performance, low latency audio and MIDI support built in, and there is usually less dependence on driver quality than on the PC, so less risk of driver/compatibility problems. On PC platforms either ASIO or DirectSound drivers can be used, with good quality native ASIO drivers usually giving by far the best performance.

Any audio interface you use must natively support the sample rates used by the organs you wish to load into Hauptwerk (typically 44.1 kHz, 48 kHz and 96 kHz). Note that the default built-in sound output found on many computers, only supports 44.1 kHz and so cannot be used with sample sets requiring other sample rates, such as 48 kHz. The sound quality from most computers' built-in outputs is also not usually especially high.

Since it is impossible for us to test with all products, and some interfaces do have problems with some types of drivers on some platforms, we would either recommend using one of the following interfaces, which we test with and fully support, or we would recommend testing an evaluation version of Hauptwerk with your system before purchasing a license.

On Mac OS X 10.6 'Snow Leopard' our recommendations are:

- Echo Audiofire 12 (firewire), which has 12 analogue (mono) outputs.
- Echo Audiofire 8 (firewire), which has 8 analogue (mono) outputs.
- PreSonus FP-10 (firewire), which has 8 analogue (mono) outputs.
- RME FireFace 800 (firewire), which has 8 analogue (mono) outputs.

On Mac OS X 10.5 'Leopard' our recommendations are:

- Echo Audiofire 12 (firewire), which has 12 analogue (mono) outputs.
- Echo Audiofire 8 (firewire), which has 8 analogue (mono) outputs.
- MOTU 24 I/O (PCIe version), which has 24 analogue (mono) outputs. Mac Pro only.
- PreSonus FP-10 (firewire), which has 8 analogue (mono) outputs.
- RME FireFace 800 (firewire), which has 8 analogue (mono) outputs.
- M-Audio FireWire Audiophile (firewire), which has 2 analogue (mono) outputs.
- M-Audio FireWire 410 (firewire), which has 8 analogue (mono) outputs.
- M-Audio Audiophile 2496 (PCI card), which has 2 analogue (mono) outputs. G4/G5 Macs only.
- M-Audio Audiophile 1010/1010LT (PCI card), which has 8 analogue (mono) outputs. G4/G5 Macs only.

On Mac OS X 10.4 'Tiger' our recommendations are:

- Echo Audiofire 12 (firewire), which has 12 analogue (mono) outputs.
- Echo Audiofire 8 (firewire), which has 8 analogue (mono) outputs.
- MOTU 24 I/O (PCIe version), which has 24 analogue (mono) outputs. Mac Pro only.
- PreSonus FP-10 (firewire), which has 8 analogue (mono) outputs.
- RME FireFace 800 (firewire), which has 8 analogue (mono) outputs.
- M-Audio FireWire Audiophile (firewire), which has 2 analogue (mono) outputs.
- M-Audio FireWire 410 (firewire), which has 8 analogue (mono) outputs.
- M-Audio Audiophile 2496 (PCI card), which has 2 analogue (mono) outputs. G4/G5 Macs only.
- M-Audio Audiophile 1010/1010LT (PCI card), which has 8 analogue (mono) outputs. G4/G5 Macs only.

On 64-bit and 32-bit Windows 7 our recommendations are:

- Echo Audiofire 12 (firewire), which has 12 analogue (mono) outputs. *(1) (3)*
- Echo Audiofire 8 (firewire), which has 8 analogue (mono) outputs. *(1) (3)*
- MOTU 24 I/O (PCIe version), which has 24 analogue (mono) outputs.
- RME FireFace 800 (firewire), which has 8 analogue (mono) outputs.
- E-MU 1212M (PCI card), which has 2 analogue (mono) outputs and built-in reverb. *(3)*
- E-MU 1820/1820M (PCI card), which has 8 analogue (mono) outputs and built-in reverb. *(3)*
- E-MU 0404 (PCI card), which has 2 analogue (mono) outputs and built-in reverb. *(3)*
- M-Audio FireWire Audiophile (firewire), which has 2 analogue (mono) outputs. *(3)*
- M-Audio FireWire 410 (firewire), which has 8 analogue (mono) outputs. *(3)*
- M-Audio Audiophile 2496 (PCI card), which has 2 analogue (mono) outputs. *(3)*
- M-Audio 1010/1010LT (PCI card), which has 8 analogue (mono) outputs. *(3)*

On 64-bit or 32-bit Windows Vista our recommendations are:

- Echo Audiofire 12 (firewire), which has 12 analogue (mono) outputs. *(1)*
- Echo Audiofire 8 (firewire), which has 8 analogue (mono) outputs. *(1)*
- MOTU 24 I/O (PCIe version), which has 24 analogue (mono) outputs.
- PreSonus FP-10 (firewire), which has 8 analogue (mono) outputs.
- RME FireFace 800 (firewire), which has 8 analogue (mono) outputs.
- E-MU 1212M (PCI card), which has 2 analogue (mono) outputs and built-in reverb.
- E-MU 1820/1820M (PCI card), which has 8 analogue (mono) outputs and built-in reverb.
- E-MU 0404 (PCI card), which has 2 analogue (mono) outputs and built-in reverb.
- M-Audio FireWire Audiophile (firewire), which has 2 analogue (mono) outputs.
- M-Audio FireWire 410 (firewire), which has 8 analogue (mono) outputs.
- M-Audio Audiophile 2496 (PCI card), which has 2 analogue (mono) outputs.
- M-Audio 1010/1010LT (PCI card), which has 8 analogue (mono) outputs.

On 64-bit or 32-bit Windows XP our recommendations are:

- Echo Audiofire 12 (firewire), which has 12 analogue (mono) outputs. *(1)*
- Echo Audiofire 8 (firewire), which has 8 analogue (mono) outputs. *(1)*
- MOTU 24 I/O (PCIe version), which has 24 analogue (mono) outputs.
- PreSonus FP-10 (firewire), which has 8 analogue (mono) outputs.
- RME FireFace 800 (firewire), which has 8 analogue (mono) outputs.
- E-MU 1212M (PCI card), which has 2 analogue (mono) outputs and built-in reverb.
- E-MU 1616M (PCI card), which has 6 analogue (mono) outputs and built-in reverb.
- E-MU 0404 (PCI card), which has 2 analogue (mono) outputs and built-in reverb.
- M-Audio FireWire Audiophile (firewire), which has 2 analogue (mono) outputs. *(2) (3)*
- M-Audio FireWire 410 (firewire), which has 8 analogue (mono) outputs. *(2) (3)*
- M-Audio Audiophile 2496 (PCI card), which has 2 analogue (mono) outputs. *(2) (3)*
- M-Audio 1010/1010LT (PCI card), which has 8 analogue (mono) outputs. *(2) (3)*

(1) We found that performance of the onboard MIDI ports was sluggish with the current Echo drivers for 64-bit Windows (only). Hence we would currently recommend using a separate MIDI interface with the Echo Audiofire interfaces on 64-bit Windows platforms.

(2) The current M-Audio 64-bit ASIO drivers only work with 32-bit Hauptwerk, limiting usable memory to 4 GB.

(3) The current 64-bit drivers for this interface are beta and/or not fully supported by the manufacturer. We found them to work but you might not be able get support from the manufacturer if you have a problem.

On both Mac and Windows platforms, the Echo, MOTU and M-Audio (1010/1010LT and 2496 only) drivers allow several units to be connected to the computer at the same time to give more outputs.

The Echo, MOTU, PreSonus, RME, E-MU and M-Audio websites have their full specifications.

Professional or semi-professional audio interfaces with high-quality DACs and drivers are strongly recommended above consumer-level sound cards. Apart from audio quality, the quality of the audio interface and its drivers can have an enormous effect on performance, as much as halving or doubling the number of pipes that your computer will be able to sound simultaneously, and determining the delay between pressing a key and hearing the sound ('latency').

Unless specifically advised to do otherwise, it is usually best to ensure that the latest versions of the manufacturers' drivers and firmware are installed.

Please note that the Creative Audigy 2 interfaces, commonly-used in PCs, do have ASIO drivers, but those drivers do not fully support multiple sample rates, and thus cannot be used with some Hauptwerk sample sets in ASIO mode. However, the Creative Audigy 2 interfaces do have fairly low-latency DirectSound drivers on both 32 and 64-bit editions of Windows. In general, we do not recommend the Creative interfaces for use with Hauptwerk because of their restrictive ASIO drivers, although they can instead be used with DirectSound drivers.

Notes about audio interface compatibility with 64-bit Windows: If you intend to use Hauptwerk on 64-bit Windows, please check the website of your intended audio interface's manufacturer for genuine 64-bit ASIO driver support, and, if possible, test the interface with Hauptwerk first, since some 64-bit Windows drivers do not fully work with native 64-bit audio/MIDI software.

MIDI interfaces

Similarly, any MIDI interface supported by the manufacturer on your system should work with Hauptwerk. For maximum compatibility with our testing we would recommend using one of the following.

Please note that we do not recommend very small 'micro' USB-MIDI interface, such as the M-Audio MIDISPORT UNO, since we have found some such interfaces to have insufficient hardware buffering and to lose occasional MIDI messages when the computer's processor is heavily loaded, causing stuck notes in Hauptwerk. That should never occur if using a good quality MIDI interface with plenty of buffering, such as any of those we recommend here.

On Mac OS X 10.6 'Snow Leopard' our recommendations are:

- MOTU Micro Lite (USB): 5 MIDI input ports, 5 MIDI output ports.
- MOTU Express 128 (USB): 8 MIDI input ports, 8 MIDI output ports.
- M-Audio MIDISPORT 2x2 Anniversary Edition (USB): 2 MIDI input ports, 2 MIDI output ports. *(2)*
- M-Audio MIDISPORT 4x4 Anniversary Edition (USB): 4 MIDI input ports, 4 MIDI output ports. *(2)*
- Echo Audiofire 12 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- Echo Audiofire 8 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- PreSonus FP-10 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- RME FireFace 800 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.

On Mac OS X 10.5 'Leopard' our recommendations are:

- MOTU Micro Lite (USB): 5 MIDI input ports, 5 MIDI output ports.
- MOTU Express 128 (USB): 8 MIDI input ports, 8 MIDI output ports.
- M-Audio MIDISPORT 2x2 Anniversary Edition (USB): 2 MIDI input ports, 2 MIDI output ports.
- M-Audio MIDISPORT 4x4 Anniversary Edition (USB): 4 MIDI input ports, 4 MIDI output ports.
- Echo Audiofire 12 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- Echo Audiofire 8 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- PreSonus FP-10 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- RME FireFace 800 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- M-Audio FireWire Audiophile audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- M-Audio FireWire 410 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- M-Audio Audiophile 2496 audio interface (PCI card): 1 MIDI input port, 1 MIDI output port. G4/G5 Macs only.
- M-Audio 1010/1010LT audio interface (PCI card): 1 MIDI input port, 1 MIDI output port. G4/G5 Macs only.

On Mac OS X 10.4 'Tiger' our recommendations are:

- MOTU Micro Lite (USB): 5 MIDI input ports, 5 MIDI output ports.
- MOTU Express 128 (USB): 8 MIDI input ports, 8 MIDI output ports.
- M-Audio MIDISPORT 2x2 Anniversary Edition (USB): 2 MIDI input ports, 2 MIDI output ports.
- M-Audio MIDISPORT 4x4 Anniversary Edition (USB): 4 MIDI input ports, 4 MIDI output ports.
- Echo Audiofire 12 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- Echo Audiofire 8 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- PreSonus FP-10 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- RME FireFace 800 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- M-Audio FireWire Audiophile audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- M-Audio FireWire 410 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- M-Audio Audiophile 2496 audio interface (PCI card): 1 MIDI input port, 1 MIDI output port. G4/G5 Macs only.
- M-Audio 1010/1010LT audio interface (PCI card): 1 MIDI input port, 1 MIDI output port. G4/G5 Macs only.

On 64-bit or 32-bit Windows 7 our recommendations are:

- MOTU Micro Lite (USB): 5 MIDI input ports, 5 MIDI output ports.
- MOTU Express 128 (USB): 8 MIDI input ports, 8 MIDI output ports.
- M-Audio MIDISPORT 2x2 Anniversary Edition (USB): 2 MIDI input ports, 2 MIDI output ports. *(2)*
- M-Audio MIDISPORT 4x4 Anniversary Edition (USB): 4 MIDI input ports, 4 MIDI output ports. *(2)*
- Echo Audiofire 12 audio interface (firewire): 1 MIDI input port, 1 MIDI output port. *(1) (2)*
- Echo Audiofire 8 audio interface (firewire): 1 MIDI input port, 1 MIDI output port. *(1) (2)*
- RME FireFace 800 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- E-MU 1212M audio interface (PCI card): 1 MIDI input port, 1 MIDI output port. *(2)*
- E-MU 1616M audio interface (PCI card): 2 MIDI input ports, 2 MIDI output ports. *(2)*
- E-MU 0404 audio interface (PCI card): 1 MIDI input port, 1 MIDI output port. *(2)*
- M-Audio FireWire Audiophile audio interface (firewire): 1 MIDI input port, 1 MIDI output port. *(2)*
- M-Audio FireWire 410 audio interface (firewire): 1 MIDI input port, 1 MIDI output port. *(2)*
- M-Audio Audiophile 2496 audio interface (PCI card): 1 MIDI input port, 1 MIDI output port. *(2)*
- M-Audio 1010/1010LT audio interface (PCI card): 1 MIDI input port, 1 MIDI output port. *(2)*

On 64-bit or 32-bit Windows Vista our recommendations are:

- MOTU Micro Lite (USB): 5 MIDI input ports, 5 MIDI output ports.
- MOTU Express 128 (USB): 8 MIDI input ports, 8 MIDI output ports.
- M-Audio MIDISPORT 2x2 Anniversary Edition (USB): 2 MIDI input ports, 2 MIDI output ports.
- M-Audio MIDISPORT 4x4 Anniversary Edition (USB): 4 MIDI input ports, 4 MIDI output ports.
- Echo Audiofire 12 audio interface (firewire): 1 MIDI input port, 1 MIDI output port. *(1)*
- Echo Audiofire 8 audio interface (firewire): 1 MIDI input port, 1 MIDI output port. *(1)*
- PreSonus FP-10 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- RME FireFace 800 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- E-MU 1212M audio interface (PCI card): 1 MIDI input port, 1 MIDI output port.
- E-MU 1616M audio interface (PCI card): 2 MIDI input ports, 2 MIDI output ports.
- E-MU 0404 audio interface (PCI card): 1 MIDI input port, 1 MIDI output port.
- M-Audio FireWire Audiophile audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- M-Audio FireWire 410 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- M-Audio Audiophile 2496 audio interface (PCI card): 1 MIDI input port, 1 MIDI output port.
- M-Audio 1010/1010LT audio interface (PCI card): 1 MIDI input port, 1 MIDI output port.

On 64-bit or 32-bit Windows XP our recommendations are:

- MOTU Micro Lite (USB): 5 MIDI input ports, 5 MIDI output ports.
- MOTU Express 128 (USB): 8 MIDI input ports, 8 MIDI output ports.
- Echo Audiofire 12 audio interface (firewire): 1 MIDI input port, 1 MIDI output port. *(1)*
- Echo Audiofire 8 audio interface (firewire): 1 MIDI input port, 1 MIDI output port. *(1)*
- PreSonus FP-10 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- RME FireFace 800 audio interface (firewire): 1 MIDI input port, 1 MIDI output port.
- E-MU 1212M audio interface (PCI card): 1 MIDI input port, 1 MIDI output port.
- E-MU 1616M audio interface (PCI card): 2 MIDI input ports, 2 MIDI output ports.
- E-MU 0404 audio interface (PCI card): 1 MIDI input port, 1 MIDI output port.
- M-Audio FireWire Audiophile audio interface (firewire): 1 MIDI input port, 1 MIDI output port. *(2)*
- M-Audio FireWire 410 audio interface (firewire): 1 MIDI input port, 1 MIDI output port. *(2)*
- M-Audio Audiophile 2496 audio interface (PCI card): 1 MIDI input port, 1 MIDI output port. *(2)*
- M-Audio 1010/1010LT audio interface (PCI card): 1 MIDI input port, 1 MIDI output port. *(2)*

(1) We found that performance of the onboard MIDI ports was sluggish with the current Echo drivers for 64-bit Windows (only). Hence we would currently recommend using a separate MIDI interface with the Echo Audiofire interfaces on 64-bit Windows platforms.

(2) The current drivers for this interface are beta and/or not fully supported by the manufacturer. We found them to work but you might not be able get support from the manufacturer if you have a problem.

Details of the interfaces can be found on the Echo, MOTU, PreSonus, RME, E-MU and M-Audio websites.

Unless specifically advised to do otherwise, it is usually best to ensure that the latest versions of the manufacturers' drivers and firmware are installed.

Monitors and graphics cards

Hauptwerk requires a minimum display resolution of 1024 x 768 pixels with 16, 24 or 32-bit color depth. Some sample sets may require higher resolutions in order to be able to display larger organ consoles. Note that Hauptwerk's console display can be disabled for use without a monitor.

On Windows PCs, when using Hauptwerk and the St. Anne's sample set with a screen resolution of 1024 x 768 we recommend using *Start | Settings | Control Panel | Display*, selecting the *Appearance* tab, changing the *Windows and buttons* setting to *Windows Classic* style and clicking *OK*. Then right-click on the Windows task bar and select *Properties*, tick *Auto-hide the task bar* and click *OK*. This should enable the console to fit fully on the screen.

Touch-screens are very popular for use with Hauptwerk, since they provide a simple and effective interface to control Hauptwerk's stops, avoiding the need for MIDI draw-knobs/tabs, etc. or any complex MIDI configuration. Many Hauptwerk users use MIDI piston buttons to trigger Hauptwerk's combinations and a touch-screen to program those combinations, which is very simple to configure but convenient for performance.

The Advanced Edition of Hauptwerk has native support for up to four monitors, including touch-screens, allowing different virtual console windows to be shown on separate physical monitors. For example you could display stop jambs on either side of your MIDI keyboards using two monitors.

VST hosts

The 32-bit VSTi plug-in version of Hauptwerk is currently fully supported and tested with the following VST hosts on 32 or 64-bit Windows platforms (only):

- Steinberg Cubase 4
- Steinberg Cubase SE 3
- Steinberg V-STack 1.2 *(3)*
- Cakewalk Sonar 6.2 and above (both 64-bit and 32-bit)
- Sibelius 5 *(2)*
- GenieSoft Overture 4 *(2)*
- Brainspawn Forte 1.6 *(1) (2)*
- Image-Line FL Studio 7
- Magix Samplitude 9 *(1)*
- VSTHost 1.40 (freeware)*(2)*

The 64-bit VSTi plug-in version of Hauptwerk, running on 64-bit Windows is currently supported on the following:

- Cakewalk Sonar 6.2 and above (64-bit)

(1) This host does not allow a plug-in to re-size its 'editor' window, which is necessary when a sample set is loaded or unloaded in Hauptwerk, or Hauptwerk is activated or deactivated. With the majority of such hosts closing and re-opening the window will force the host to redraw the window at the correct size.

(2) This host does not support multiple audio outputs with Hauptwerk, so only a single mixed stereo output is possible.

(3) This host does not support multiple sample rates natively. To use sample sets which require rates other than 44.1 kHz you need an audio interface that allows the sample rate to be adjusted and locked to force the host to run at that sample rate.

The Hauptwerk VSTi plug-in should be compatible with the majority of other VST hosts on the PC platform. Although we cannot test on all hosts, as much as possible we will endeavor to support Hauptwerk on any current host provided that we can obtain a testing copy from the manufacturer and that any compatibility issues prove to be due to Hauptwerk and not the host itself.

In this release there is no plug-in version of Hauptwerk for the Apple Mac platform, but we plan to add one in the future. However, Audio Hijack Pro can be used to apply reverb/convolver plug-ins very easily to Hauptwerk's audio output in real-time. Note that it is also possible to use the third-party freeware Jack OS X utility to route audio output from Hauptwerk into an audio sequencer or software effects processor in real-time. However, it is quite technical and we think some less-experienced computer users might find it complex to configure.

Other MIDI sequencer software

In principle any MIDI sequencer software should be compatible with Hauptwerk. A 'virtual MIDI cable' is required to connect Hauptwerk to a non-VSTi MIDI sequencer running on the same computer.

Mac OS X includes one natively, called the 'IAC Driver', but it is disabled by default. On an Apple Mac please run /Applications/Utilities/Audio MIDI Setup, click on the MIDI Devices tab, double-click on the IAC Driver icon and then make sure that the Device is online option is ticked. It is preferable (but not essential) to do this before running Hauptwerk, since Hauptwerk will then automatically default to using the driver for its 'MIDI sequencer' configuration when it is run for the first time.

On Windows platforms a third-party program is required, such as MIDI Yoke.

On 64-bit Windows, MIDI Yoke works with 32-bit Hauptwerk but not with 64-bit Hauptwerk. LoopBe is compatible with native 64-bit software.

MIDI keyboards and organ consoles

To play Hauptwerk 'live' you need at least one MIDI keyboard, or a MIDI organ console, plus leads to connect it to the computer's MIDI interface. Hauptwerk is designed to be compatible with the MIDI implementations found in the majority of digital and electronic organs, so that MIDI draw-knobs, pistons, swell shoes and so forth can control Hauptwerk and be controlled by Hauptwerk where the hardware allows it *(1)*. Please see the MIDI implementation section of the user guide for details of the MIDI implementations supported by Hauptwerk.

As noted above, touch-screens are very popular for use with Hauptwerk, since they provide a simple and effective interface to control Hauptwerk's stops, avoiding the need for MIDI draw-knobs/tabs, etc. or any complex MIDI configuration. Many Hauptwerk users use MIDI piston buttons to trigger Hauptwerk's combinations and a touch-screen to program those combinations, which is very simple to configure but convenient for performance. Hauptwerk has native support for up to four monitors *(1)*, including touch-screens, allowing different virtual console windows to be shown on separate physical monitors. For example you could display stop jambs on either side of your MIDI keyboards using two monitors.

(1) MIDI output facilities and multi-monitor support are only available in the Advanced Edition of Hauptwerk.

Amplifier, speakers or headphones

Hauptwerk produces audio output signals through the computer's audio interface(s). Amplifiers and loudspeakers or headphones will then be required to turn those signals into sound.

The quality of the audio amplifiers and speakers is critical; there is no point spending a lot of money on a computer and audio interface and then using PC speakers - the results will almost certainly be terrible. At the very least, a good quality stereo hi-fi amplifier and pair of speakers should be used, or good quality hi-fi headphones. Recording studio monitor speakers are usually good alternatives. For amplification in large buildings, it is often better to have many smaller high-quality amplifiers and speakers than a few high-powered ones.

Hauptwerk fully supports multi-channel audio output *(1)*, so you can amplify different organ ranks, or parts of ranks, separately if you wish and have a multi-output audio interface. You can also distribute pipes within groups of available channels. This enables a three-dimensional sound to be created and minimizes some types of distortion inherent in loudspeakers. It is usually the preferred method of amplification with dry sample sets used in reverberant spaces.

(1) Multi-channel audio output is only available with the Advanced Edition of Hauptwerk.

Spare USB port

Hauptwerk is licensed by means of the Hauptwerk USB key. To use a licensed version of Hauptwerk you will need a spare USB port to connect it. If your computer does not have sufficient ports then you will need to get a USB hub and cable to add more. We recommend only using good quality USB hubs with separate power supplies to ensure that the dongle functions reliably.

Important note 1: Since it is not possible for us to test with all hardware and third-party software, we would recommend testing an evaluation version of Hauptwerk with your system before purchasing a license.

Important note 2: Milan Digital Audio does not make or sell computer hardware. We hope you find any recommendations

we give useful as reference but we cannot guarantee that any given combination of PC parts or drivers will work or perform well together, regardless of whether some of them follow our recommendations. We are sorry we cannot provide a significant level of help or advice for computer hardware, beyond the recommendations made in the user guide and on our website. If you need help or support with building PCs, using computers, or buying, installing or using PC components, please make sure that you have a support contract with a company that can provide that support. If you are considering buying a computer to run Hauptwerk and you do not have much experience with building computers, diagnosing driver and hardware compatibilities, and so forth, we would recommend either buying an Apple Mac (Apple Macs give superb performance 'out of the box') or buying a PC from a company that offers ready-made high-performance PCs designed and tested for use with Hauptwerk. The MIDI hardware section on our website lists several such companies.

Installation: background information

Licenses and the Hauptwerk USB key

If you have purchased a full licensed copy of Hauptwerk you will have received a small USB device called a 'Hauptwerk USB key' (in computing terms, a 'USB dongle') with it. The Hauptwerk USB key is your license for Hauptwerk and must be attached to a spare USB port on your computer at all times when you are running Hauptwerk.

Hauptwerk's installer automatically installs or upgrades the necessary hardware device driver for the USB key, and Hauptwerk functions either as a licensed application, or in evaluation/Free Edition mode, depending on whether the USB key is attached to the computer.

If you have been using Hauptwerk in unlicensed/evaluation mode, and then decide to buy a license, all that is necessary is to connect the Hauptwerk USB key to the computer to turn your unlicensed installation into a licensed one. There is no need to re-run Hauptwerk's installer. However, you must never attach or detach the USB key while Hauptwerk is actually running.

Once a Hauptwerk USB key has been installed, the periodic triangle chime that is audible in the evaluation version will no longer be present when a sample set is loaded.

If you have a license for the smaller Basic Edition (previously named Studio Edition) and you want to evaluate features in the full Advanced Edition (previously known as the Concert Edition), simply exit Hauptwerk and disconnect your Hauptwerk USB key temporarily. When you launch Hauptwerk again it will allow you to run it as an evaluation version, allowing you to try out the functionality of the Advanced Edition. Reconnecting your Hauptwerk USB key your will return you to your licensed Basic Edition. No settings will be lost in the process.

Important: Do not lose the Hauptwerk USB key, since we cannot normally replace it unless you buy a new license. Please see the licensing section for more information about the USB key and licensing.

Understanding the configurations

It is only possible to have one copy of Hauptwerk installed on a given computer (unless you have multiple operating system disk partitions). If the installer detects that Hauptwerk is already installed, it will only allow that copy to be upgraded or re-installed.

However, several independent Hauptwerk configurations will automatically be installed, each allowing its own entirely separate set of configuration settings within Hauptwerk, and launched via different short-cuts/aliases. Any settings you change within Hauptwerk in one configuration will not affect the other two.

Sample sets, licenses and other installable components, combination files and files recorded from Hauptwerk's built-in output recording system are automatically shared between all three. The configurations are:

Stand-alone configuration

This is the main default Hauptwerk configuration. Once installed, it is launched by double-clicking on *Hauptwerk (stand-alone)* icon on your desktop (or in the *Start* menu on Windows systems). It is intended and configured by default to be appropriate for using Hauptwerk as a stand-alone program (not with a MIDI sequencer), which you play in real-time from MIDI keyboards or an organ console.

MIDI sequencing configuration

This configuration is identical to, but entirely independent from the stand-alone configuration. Once installed, it is launched by double-clicking on the *Hauptwerk (for MIDI sequencing)* icon on your desktop (or in the *Start* menu on Windows systems). It is intended and configured by default to be appropriate for using Hauptwerk with a non-VSTi compatible MIDI sequencer, together with a 'virtual MIDI cable' to route MIDI output from the sequencer to Hauptwerk, such as the native *IAC Driver* on the Apple Mac or the third-party freeware *MIDI Yoke* or *LoopBe* software on Windows (see the links page on the Hauptwerk website).

VSTi plug-in configuration

This configuration, also entirely independent from the other two, is configured only for use as a VSTi plug-in from within a third-party VST-compatible host program, such as Steinberg V-STack, Steinberg Cubase or Cakewalk Sonar. It is launched by selecting Hauptwerk from the list of available VSTi plug-in instruments within your VST host program, if you have one.

On the Apple Mac platform, currently only the first two configurations are available, since there is not yet a plug-in version of Hauptwerk for the Apple Mac. However, we plan to add one soon.

Copying settings between configurations

You can copy settings between the configurations if you wish using Hauptwerk's native backup/restore functionality, covered later in this guide. The backup/restore functionality also allows you to copy your settings, organ combinations and other 'user' data from one computer (or operating system disk partition) to another.

Planning installation locations

During installation, it is possible to choose to install different groups of Hauptwerk's files into different folders or on different disk drives. The files are grouped according to their size and backup requirements.

There are two 'installation sets' from which you will be able to choose during installation: *Simple* and *Custom*.

The *Simple* set installs all files into default folders on your computer's main hard disk, and is the most appropriate choice for most users, especially if you only have one hard disk (or a single RAID array) installed in the computer.

On the Apple Mac, the Simple option installs the Hauptwerk software itself into */Applications/Hauptwerk* and all data files are installed into */Hauptwerk*. On Windows PCs, the Simple option install the Hauptwerk software into *Program Files**Hauptwerk Virtual Pipe Organ* and all data files into *Hauptwerk*.

It is the *Custom* option that allows the data file groups to be installed to separate locations, and you may wish to choose this option if you are an experienced computer user and have more than one hard drive or more than one RAID array, across which you wish to optimize disk access or space usage. If you decide that you wish to use the Custom installation set, you should plan how you wish to lay out the folders before running the installer. If you are building a new computer, you may wish to lay out the file systems or RAID arrays at this stage. Once Hauptwerk has been installed, the installation locations cannot be changed without un-installing Hauptwerk and then re-installing it.

The groups of files, whose installation folders can be adjusted are:

- ***User data files***. Files containing your settings and data, such as configuration files, saved combinations and log files. Reliable disk storage should be used and it is recommended that the files be backed up regularly. Hauptwerk's native backup/restore functionality can be used to back them up. Recommended size for growth: 500 MB - 2 GB.
- ***Sample sets and components***. Sample sets, sample data, temperament files, and other install-able components. Place this folder on a large hard disk or array. Storage need not be secure, since all data can be re-installed. Recommended size for growth: 5 - 100 GB.
- ***Internal working data files***. Processing and analysis is performed the first time a sample set is loaded. The resulting data are stored in a 'sample set data cache' for the sample set within this folder so that it can load much more rapidly subsequently. Ideally these files should be placed on a large, fast disk or array for speed. A fast RAID array (RAID 1 or RAID 5 are recommended) is ideal. Recommended size for growth: 5 - 100 GB.
- ***Recorded output files***. Files produced from Hauptwerk's built-in recording system. Recommended size for growth: 1 - 20 GB.

On Windows only, for both Simple and Custom installation sets, you will also need to select a folder into which the VSTi plug-in will be installed. If you have a VSTi host program, such as Steinberg V-STack, Steinberg Cubase or Cakewalk Sonar, the required folder will be the special VST plug-ins folder used by the host program (*\Program Files\Steinberg\V-STack\Vstplugins*, for example). If you do not have a VSTi host program, or will not be using Hauptwerk as a VSTi plug-in, simply leave the installation option at its default and Hauptwerk's installer will install the plug-in component to an appropriate default location.

(Note that the installer places all files for a given group within a sub-folder of the folder you select for the group, named accordingly for the group. For example, a sub-folder named HauptwerkUserData will be created for the user data files within the folder you select for the user data files group. The VSTi folder is an exception, in that the VST plug-in is created directly within the folder you select.)

Shared vs. multi-user environments

Because the configuration required to integrate Hauptwerk with a MIDI organ console may involve quite a large number of settings, while most of Hauptwerk's settings relate to the hardware with which it is being used, and also because the sample set data caches are dependent on the configuration and may be very large (for example, 5 - 50 GB), it is best to have all computer accounts sharing the same Hauptwerk settings in most cases, which is how Hauptwerk's installer configures the installation.

In special cases where you may have more complex multi-user configuration or security requirements, for example in a school or music college, please contact Milan Digital Audio to discuss your installation requirements.

Installing Hauptwerk

These instructions apply when you install Hauptwerk on a computer for the first time. If you have already installed Hauptwerk version 2 or above on the computer, then please instead see the section covering upgrading.

Note that you do not need to re-install Hauptwerk if you have previously installed an unlicensed/evaluation copy of this version of Hauptwerk and then subsequently buy a license for Hauptwerk; simply connect the Hauptwerk USB key to the computer while Hauptwerk is not running.

Installation steps on an Apple Mac computer

Step 1. First ensure that your system meets the prerequisites. In particular, make sure your computer has at least 512 MB of memory (ideally 1 GB or more) and at least 4 GB of free space on the hard-disk and that you are running Mac OS X 10.6, 10.5 or 10.4, with all updates applied. (There were some serious OS X bugs that affected Hauptwerk or its installer, which are fixed by making sure that the latest OS X updates are applied.)

Step 2. Make sure your audio and MIDI interface hardware is attached to the computer, powered up, and that you have installed the most recent drivers available from the manufacturer(s).

Step 3. In Finder, navigate to */Applications/Utilities* and double-click on *Audio MIDI Setup*. Click on the *MIDI Devices* tab, then double-click on the *IAC Driver* icon. In the window that opens, make sure that *Device is online* is ticked, then click *Apply* and select *Audio MIDI Setup | Quit Audio MIDI Setup* from the menu.

Step 4. If you are installing Hauptwerk from a DVD, insert the DVD and then use Finder to navigate to the *Install_Mac* folder on the DVD. If instead you downloaded Hauptwerk, navigate to your downloaded file (by default, it will have been placed on your desktop).

Step 5. In Finder, double-click on the Hauptwerk installation .dmg (disk image) file. Please do not skip the (important) verification stage. If any checksum or other errors are reported, and you had downloaded Hauptwerk, please try downloading it again. If any errors are reported and you are installing from DVD, please check the DVD for dirt or scratches, and contact your Hauptwerk vendor for a replacement if necessary.

Step 6. Double-click on the *InstallHauptwerk* icon that appears in the disk image's window, launching Hauptwerk's installer. A screen will appear stating that you need an administrator password to install the software. Click on the lock icon and enter the administrator password for your computer (if you have only one account on the computer, you should just enter your computer password). Then follow the instructions in the installer to complete the installation process.

Important: Please don't cancel the installer after you have clicked *Install* on the its final summary screen, otherwise a partial, broken installation may result. Please also ensure that you don't re-launch the installer for at least one minute after it has finished, since running two instances of the installer may also result in a corrupted installation. (The installer might keep running in the background for a few moments after it appears to have closed.)

Step 7. If you have purchased a license for Hauptwerk, attach the Hauptwerk USB key to a spare USB port on your computer. An orange indicator should light inside the USB key.

Step 8. Launch Hauptwerk by double-clicking on the *Hauptwerk (stand-alone)* icon on your desktop. Please now make a backup of your Hauptwerk settings and data following the step-by-step 'How to make a backup' instructions in the backups section of the guide. Doing so should allow you easily to get back to your current 'factory default' settings in case you ever want to in the future.

Hauptwerk is now installed. Please now follow the relevant *Quick start* section(s) in this guide to start using it.

Installation steps on a Windows PC

Important note 1: Please do not use Windows System Restore after installing Hauptwerk, since it sometimes deletes or reverts some of Hauptwerk's files and not others, and can leave Hauptwerk in an unusable condition, while also preventing Hauptwerk's installer from being able to run to repair the installation.

Important note 2: If you have purchased a license for Hauptwerk, please do not connect the Hauptwerk USB key until after you have installed Hauptwerk, as instructed below, to ensure that only the correct version of the driver is installed, which is included in Hauptwerk's installer.

Step 1. First ensure that your system meets the prerequisites. In particular, make sure your computer has at least 512 MB of memory (ideally 1 GB or more) and at least 4 GB of free space on the hard-disk and that you have all Windows updates applied, including Direct-X 9.0 or later. You can check the version of Direct-X by selecting *Start | Run* and typing *dxdiag*. **Important**: Hauptwerk's installer may not work with earlier versions of Direct-X.

Step 2. **Important**: If you had previously disabled the Windows page file (which was recommended for Hauptwerk 2 and earlier versions) or had adjusted Windows virtual memory settings in any other way, please make sure the page file is re-enabled and set specifically back to its default of 'system managed size'. Having it disabled or set to an inappropriate size can cause stability problems, performance problems, or other severe problems with Hauptwerk, other applications, or Windows itself, especially if 4 GB or more of memory is installed. On Windows XP use *Start | Settings | Control Panel | System*, then click on the *Performance | Settings* button on the *Advanced* tab. Select *Adjust for best performance*, then click the *Advanced* tab. Leave *Processor scheduling* and *Memory usage* both set to favor *Programs*. Click *Virtual memory: Change* and select *System managed size* for the hard-disk you want Windows to use for its virtual memory, then click *Set*. Finally click *OK* on all of the windows and re-boot the computer if you changed any settings.

Step 3. Make sure your audio and MIDI interface hardware is attached to the computer, powered up, and that you have installed the most recent drivers available from the manufacturer(s).

Step 4. Make sure that you are logged onto Windows with a computer account that has administrator privileges (such as the default computer account). If not, log out and log on again using such an account.

Step 5. If you have not previously done so, and you will be using Hauptwerk with a MIDI sequencer, download and install the third-party MIDI Yoke utility (works with 32-bit Hauptwerk) or LoopBe (works with both 32-bit and 64-bit Hauptwerk). A link to download them can be found on the links page on the Hauptwerk website.

Step 6. If you are installing Hauptwerk from a DVD, insert the DVD and then use Windows Explorer to navigate to the *Install_PC* folder on the DVD. Please note that, depending on the speed of your DVD drive, it may take several minutes for the installer to open after double-clicking on it (in the next step), or for the installer file to appear in Windows Explorer, due to its size. During this time the drive activity light will remain lit. Please don't double-click on the installer multiple times in the meantime, since running two instances of the installer simultaneously can lead to a corrupted installation. If instead you downloaded Hauptwerk, navigate to your downloaded file.

Step 7. In Windows Explorer, double-click on the Hauptwerk installation .exe file. If any 'CRC' or 'unexpected end of archive' errors are reported, and you had downloaded Hauptwerk, please try downloading it again. If any 'CRC' or 'unexpected end of archive' errors are reported and you are installing from DVD, please check the DVD for dirt or scratches, and contact your Hauptwerk vendor for a replacement if necessary.

Step 8. Once the main installer screen has appeared, simply follow the instructions in the installer to complete the installation process.

Important: Please don't cancel the installer after you have clicked *Install* on the its final summary screen, otherwise a partial, broken installation may result. Please also ensure that you don't re-launch the installer for at least one minute after it has finished, since running two instances of the installer may also result in a corrupted installation. (The installer might keep running in the background for a few moments after it appears to have closed.)

(Near the end of the installation process the Hauptwerk USB key's driver is installed or upgraded automatically. Please note that you will need to acknowledge a message indicating whether it completed successfully, which might not be the uppermost window if you have switched to another application during installation. If the installation appears to have frozen while waiting for the driver installation to complete, please press Alt+Tab to verify whether the message is visible behind Hauptwerk's installer window, and simply acknowledge it if so.)

Step 9. We recommend de-fragmenting your computer's hard-disk(s), since this can significantly reduce the time required to load a sample set into Hauptwerk. On Windows XP systems, open Windows Explorer and right-click on the icon for your hard-disk, then select *Properties | Tools | Defragment Now*, then click the *Defragment* button. Defragmenting can take several hours, so you may wish to allow this to run overnight. You can do this later if you prefer.

Step 10. If you have purchased a license for Hauptwerk, attach the Hauptwerk USB key to a spare USB port on your computer. An orange indicator should light inside the USB key.

Step 11. Launch Hauptwerk by double-clicking on the *Hauptwerk (stand-alone)* icon on your desktop. Please now make a backup of your Hauptwerk settings and data following the step-by-step 'How to make a backup' instructions in the backups section of the guide. Doing so should allow you easily to get back to your current 'factory default' settings in case you ever want to in the future.

Hauptwerk is now installed. Please now follow the relevant *Quick start* section(s) in this guide to start using it.

Upgrading or re-installing Hauptwerk

These instructions apply if you already have Hauptwerk version 2 or above installed on a computer. If not, please instead see the installation section. You can check the version currently installed by selecting *Hauptwerk | About Hauptwerk* if you have an Apple Mac or *Help | About Hauptwerk* if you have a Windows PC from the Hauptwerk menu.

Note that you do not need to re-install Hauptwerk if you have previously installed an evaluation copy of this version of Hauptwerk and then subsequently buy a license for Hauptwerk; simply connect the Hauptwerk USB key to the computer while Hauptwerk is not running.

It is only possible to have one copy of Hauptwerk installed on a given computer. If the installer detects that Hauptwerk is already installed, it will only allow that copy to be upgraded or re-installed.

No settings or installed components (sample sets, temperaments, licenses, etc.) will be lost by upgrading or re-installing. However, it is good practice to make a backup of your *HauptwerkUserData* folder, which contains all of your settings, before any upgrade. We recommend writing a copy of the folder to DVD/CD as a backup and keeping that backup safely. Please be very careful not to move any of Hauptwerk's folders, otherwise your Hauptwerk installation will be broken.

Please note that it might take longer to load each organ the first time (only) after some upgrades, since the sample set data caches need to be regenerated for some new versions (not all).

Important: If your license is for version 2 and you do not update your license for the current version before installing, Hauptwerk will revert to running in unlicensed/evaluation mode but allow you to apply the license upgrade at any time to restore full licensed functionality. A computer can only have one version of Hauptwerk installed on it at any one time (unless you have multiple operating system disk partitions). Once a new version has been installed it is not possible to revert to a previous version without un-installing Hauptwerk completely (selecting the option to remove all files) then re-installing the older version, which would wipe any existing settings. Hence there is no easy way to revert to a licensed installation once version 3 has been installed other than by purchasing a license upgrade.

Upgrade/re-installation steps on an Apple Mac computer

Step 1. Please make sure that all current OS X updates are applied. (There were some serious OS X bugs that affected Hauptwerk or its installer, which are fixed by making sure that the latest OS X updates are applied.)

Step 2. Please make sure that the latest drivers are installed for your audio/MIDI interface(s). Check their manufacturers' websites for the latest versions.

Step 3. If your existing license is for version 2, for simplicity we recommend that you purchase the necessary license upgrade and apply the resulting update to your Hauptwerk USB key before upgrading Hauptwerk itself. You will be sent the necessary instructions to update the USB key once the license upgrade has been ordered. However, if your license is for version 2 and you do not update your license for the current version before installing, Hauptwerk will simply revert to running in unlicensed/evaluation mode but allow you to apply the license upgrade at any time to restore full licensed functionality.

Step 4. If you are installing Hauptwerk from a DVD, insert the DVD and then use Finder to navigate to the *Install_Mac* folder on the DVD. If instead you downloaded Hauptwerk, navigate to your downloaded file (by default, it will have been placed on your desktop).

Step 5. In Finder, double-click on the Hauptwerk installation .dmg (disk image) file. Please do not skip the (important) verification stage. If any checksum or other errors are reported, and you had downloaded Hauptwerk, please try

downloading it again. If any errors are reported and you are installing from DVD, please check the DVD for dirt or scratches, and contact your Hauptwerk vendor for a replacement if necessary.

Step 6. Double-click on the *InstallHauptwerk* icon that appears in the disk image's window, launching Hauptwerk's installer. A screen will appear stating that you need an administrator password to install the software. Click on the lock icon and enter the administrator password for your computer (if you have only one account on the computer, you should just enter your computer password). Follow the instructions in the installer to complete the installation process.

Important: Please don't cancel the installer after you have clicked *Install* on the its final summary screen, otherwise a partial, broken installation may result. Please also ensure that you don't re-launch the installer for at least one minute after it has finished, since running two instances of the installer may also result in a corrupted installation. (The installer might keep running in the background for a few moments after it appears to have closed.)

Step 7. Please now reboot the computer (otherwise the Hauptwerk icons on your desktop might not work properly for the next step).

Step 8. Launch Hauptwerk by clicking on the relevant icon on your desktop. Please now make a backup of your Hauptwerk settings and data following the step-by-step 'How to make a backup' instructions in the backups section of the guide. Doing so should allow you to get your current settings back in case your computer ever needs to be re-installed in the future.

The current version of Hauptwerk is now ready to use.

Upgrade/re-installation steps on a Windows PC

Important note: Please **do not use Windows System Restore** after installing Hauptwerk, since it sometimes deletes or reverts some of Hauptwerk's files and not others, and can leave Hauptwerk in an unusable condition, while also preventing Hauptwerk's installer from being able to run to repair the installation.

Step 1. Please make sure that all current Windows updates and service packs are applied.

Step 2. Please make sure that the latest drivers are installed for your audio/MIDI interface(s). Check their manufacturers' websites for the latest versions.

Step 3. If your existing license is for version 2, for simplicity we recommend that you purchase the necessary license upgrade and apply the resulting update to your Hauptwerk USB key before upgrading Hauptwerk itself. You will be sent the necessary instructions to update the USB key once the license upgrade has been ordered. However, if your license is for version 2 and you do not update your license for the current version before installing, Hauptwerk will simply revert to running in unlicensed/evaluation mode but allow you to apply the license upgrade at any time to restore full licensed functionality.

Step 4. Make sure that you are logged onto Windows with a computer account that has administrator privileges (such as the default computer account). If not, log out and log on again using such an account.

Step 5. **Important**: If you had previously disabled the Windows page file (which was recommended for Hauptwerk 2 and earlier versions) or had adjusted Windows virtual memory settings in any other way, please make sure the page file is re-enabled and set specifically back to its default of 'system managed size'. Having it disabled or set to an inappropriate size can cause stability problems, performance problems, or other severe problems with Hauptwerk, other applications, or Windows itself, especially if 4 GB or more of memory is installed. On Windows XP use *Start | Settings | Control Panel | System*, then click on the *Performance | Settings* button on the *Advanced* tab. Select *Adjust for best performance*, then click the *Advanced* tab. Leave *Processor scheduling* and *Memory usage* both set to favor *Programs*. Click *Virtual memory: Change*

and select *System managed size* for the hard-disk you want Windows to use for its virtual memory, then click *Set*. Finally click *OK* on all of the windows and re-boot the computer if you changed any settings.

Step 6. If you are installing Hauptwerk from a DVD, insert the DVD and then use Windows Explorer to navigate to the *Install_PC* folder on the DVD. Please note that, depending on the speed of your CD/DVD drive, it may take several minutes for the installer to open after double-clicking on it (in the next step), or for the installer file to appear in Windows Explorer, due to its size. During this time the drive activity light will remain lit. Please don't double-click on the installer multiple times in the meantime, since running two instances of the installer simultaneously can lead to a corrupted installation. If instead you downloaded Hauptwerk, navigate to your downloaded file.

Step 7. In Windows Explorer, double-click on the Hauptwerk installation .exe file. If any 'CRC' or 'unexpected end of archive' errors are reported, and you had downloaded Hauptwerk, please try downloading it again. If any 'CRC' or 'unexpected end of archive' errors are reported and you are installing from DVD, please check the DVD for dirt or scratches, and contact your Hauptwerk vendor for a replacement if necessary.

Step 8. Once the main installer screen has appeared, simply follow the instructions in the installer to complete the installation process.

Important: Please don't cancel the installer after you have clicked *Install* on the its final summary screen, otherwise a partial, broken installation may result. Please also ensure that you don't re-launch the installer for at least one minute after it has finished, since running two instances of the installer may also result in a corrupted installation. (The installer might keep running in the background for a few moments after it appears to have closed.)

(Near the end of the installation process the Hauptwerk USB key's driver is installed or upgraded automatically. Please note that you will need to acknowledge a message indicating whether it completed successfully, which may not be the uppermost window if you have switched to another application during installation. If the installation appears to have frozen while waiting for the driver installation to complete, please press Alt+Tab to verify whether the message is visible behind Hauptwerk's installer window, and simply acknowledge it if so.)

Step 9. Launch Hauptwerk by clicking on the relevant icon on your desktop. Please now make a backup of your Hauptwerk settings and data following the step-by-step 'How to make a backup' instructions in the backups section of the guide. Doing so should allow you to get your current settings back in case your computer ever needs to be re-installed in the future.

The current version of Hauptwerk is now ready to use.

Step 10. When you have loaded each of the sample sets that you normally use, we recommend de-fragmenting your computer's hard-disk(s), since this can significantly reduce the time required to load a sample set into Hauptwerk. On Windows XP systems, open Windows Explorer and right-click on the icon for your hard-disk, then select *Properties | Tools | Defragment Now*, then click the *Defragment* button. Defragmenting can take several hours, so you may wish to allow this to run overnight. You can do this later if you prefer.

Un-installing Hauptwerk

Hauptwerk has a native un-installer, which can be found in */Applications/Hauptwerk* in Finder on Mac OS X, or in the *Start | Programs | Hauptwerk Virtual Pipe Organ* menu on Windows.

If you want to remove Hauptwerk for any reason, it's essential that you un-install it using its native un-installer, rather than simply deleting some or all of its files, otherwise the installer will give errors if you try to install it again at a later date.

If you do inadvertently find yourself in that situation, please contact your Hauptwerk support provider for assistance.

Changing installation locations

If you have Hauptwerk installed but you want to change the folders/disks you installed it to, you will need to un-install Hauptwerk completely (see the preceding section), selecting the option to remove all files in the un-installer, then re-install it, selecting the *Custom* option in the installer, which allows you to choose where to install. Then re-install any sample sets that you had installed.

To ensure your settings are not lost in the process, use Hauptwerk's native backup functionality (covered in the next section) to make a backup of your settings before un-installing, then restore those settings from the backup after re-installing.

Backing up and restoring your settings and data

Overview

Hauptwerk has built-in functionality to backup your settings and personal Hauptwerk data and to restore them again. If you use the backup function periodically then you should be able to get your settings and data back easily in the future in case your computer's hard-disk fails and needs to be replaced, or if your computer gets a virus, or if your computer needs to be re-installed for any other reason. The backup/restore functions can also be used to copy your settings from one computer or Hauptwerk configuration to another.

The backup and restore functions are found on the *File* menu in Hauptwerk. *File | Backup your current Hauptwerk settings and personal data* always makes a backup copy of *all* of your Hauptwerk settings and other personal data (organ combinations, voicing, Custom Organ Design Module organs and log files) into a single compressed file, which can be written to CD/DVD or emailed easily. If you ever need to, you can then restore that backup at a later date by using the *File | Restore your current Hauptwerk settings or personal data from a backup* menu function.

Important: **Please use the backup function periodically**, and especially once you have configured Hauptwerk as you want it, and then whenever you have made a significant number of changes to your settings, organ combinations, voicing or other personal data in the future. Please store any backup files you make securely somewhere external to your computer, in case your computer's hard-disk needs to be re-installed for any reason. For example, write any backup files you make to DVDs or CDs and keep them in a safe place. You should then easily be able to get all of your Hauptwerk settings and personal data back again at any point in the future. Make sure you give the backup files meaningful names when prompted so that you can easily identify when they were made.

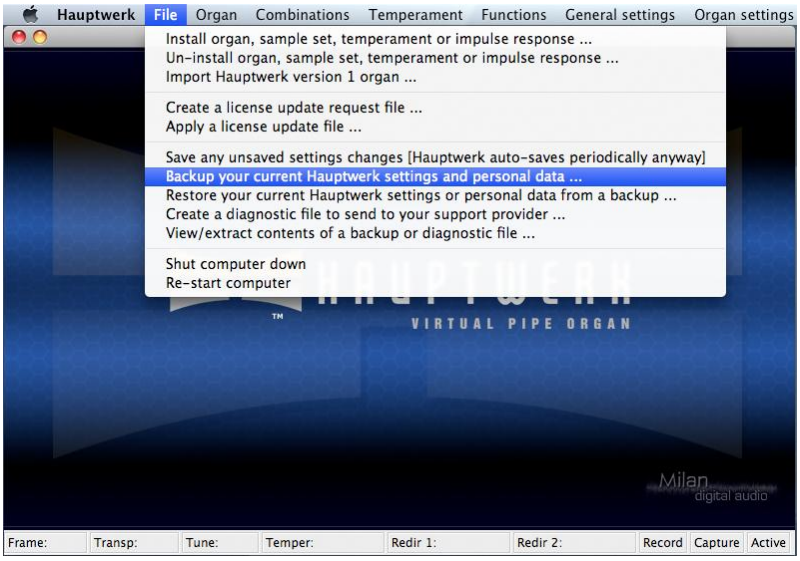
Hauptwerk does not back up the sample sets themselves (although it does back up your settings that relate to them), so please also make sure you keep the original installation media for any third-party sample sets, as well as for Hauptwerk itself. You will need those if you ever need to re-install your computer.

This section gives step-by-step instructions for the most common backup/restore operations. Some other backup/restore operations are possible using the *Advanced* restore mode.

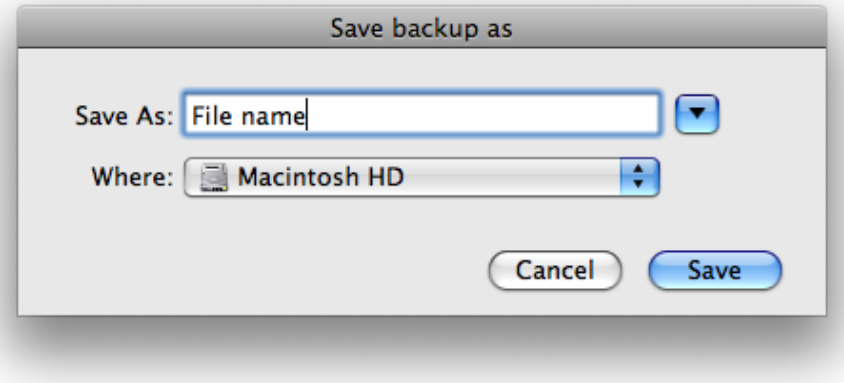
(Please note that although we make every effort to ensure that Hauptwerk's backup/restore functionality works reliably, we would always recommend also making your own independent backups of your data for maximum possible safety.)

How to make a backup

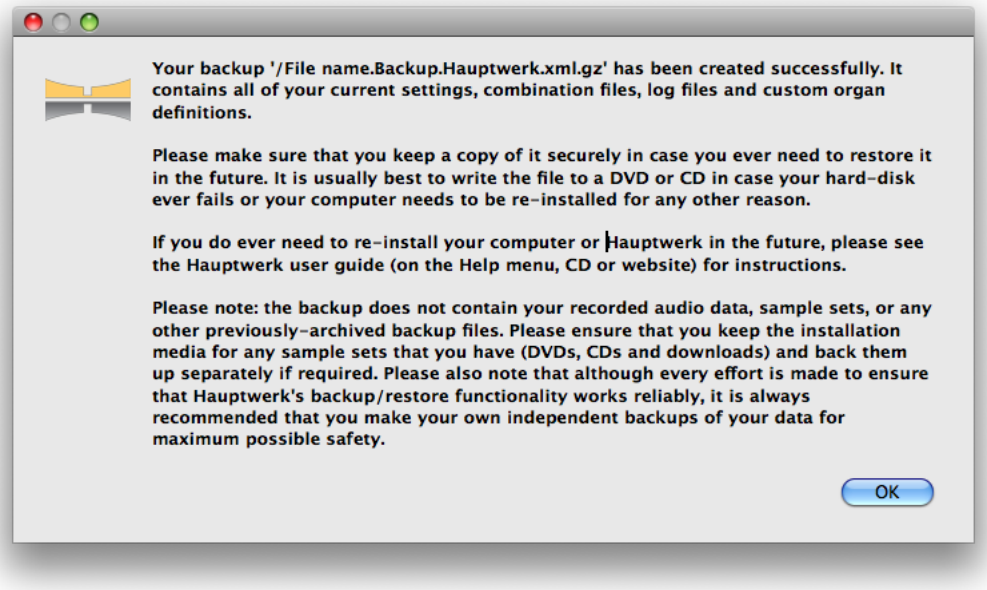
Step 1. Select *File | Backup your current Hauptwerk settings and personal data* from the Hauptwerk menu:



Step 2. A *Save as* window will appear. Use it to navigate to a location in which you want the backup file to be created. For example, choose your desktop or your home folder (Mac OS X) or My Documents folder (Windows). Type a meaningful name for the backup file, so that you will be able to identify and find it later, in case you ever needed to restore it, and then click the *Save* button:



Step 3. After a few moments a message should appear, indicating that your backup has been created successfully, similar to this:



Note down the name you gave the file and the folder in which you saved it, so that you can find it again later. Now click the *OK* button to dismiss the message.

If you do not see a success message, then please start again and make sure you type a name for the file when prompted, and that you select a folder that you are allowed to write to, such as you home folder (OS X) or your My Documents folder (Windows).

Step 4. Now use your preferred DVD/CD writing software (or the DVD/CD writing capability built into your operating system) to write the backup file you've just created to a write-able DVD or CD. Please consult the instructions for your DVD/CD writing software if needed. When writing it to DVD/CD please make sure you select the same backup file that you have just created from Hauptwerk, looking in the location you noted down in the last step to find it.

Step 5. Once the DVD or CD has been written, please label it clearly and store it somewhere that you will be able to find it again in case you ever need to restore the backup.

Moving your settings to a new/different computer or restoring them to your existing computer

If either:

- you want to install Hauptwerk on a different computer, or
- you need to re-install Hauptwerk from scratch on your existing computer (for example if its hard-disk needed to be replaced or you had to wipe the disk and reinstall the operating system because of a computer virus), or
- you want to install a new operating system on a different hard-disk or partition

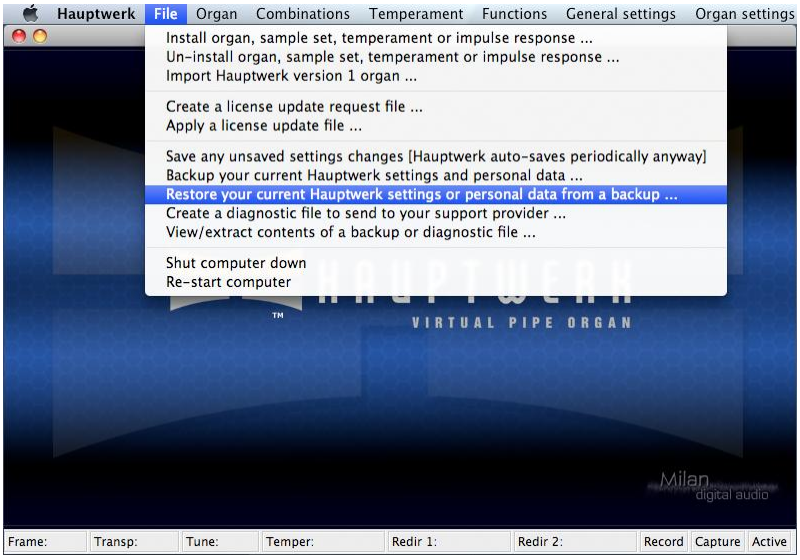
... and you want to restore your Hauptwerk settings and personal data from a backup you made previously, so that you don't have to configure Hauptwerk again from scratch, then please follow these instructions:

Step 1. First make sure that your operating system and drivers are installed properly and that all current operating system and driver updates are applied. Make sure the computer meets the Hauptwerk prerequisites.

Step 2. Now install the latest version of Hauptwerk for which you have a license, following the Hauptwerk installation instructions. You can download the latest version of Hauptwerk from the Hauptwerk website. There is no reason to install an old version and then upgrade in separate steps, even if you were using an older version previously. Just install the latest version directly.

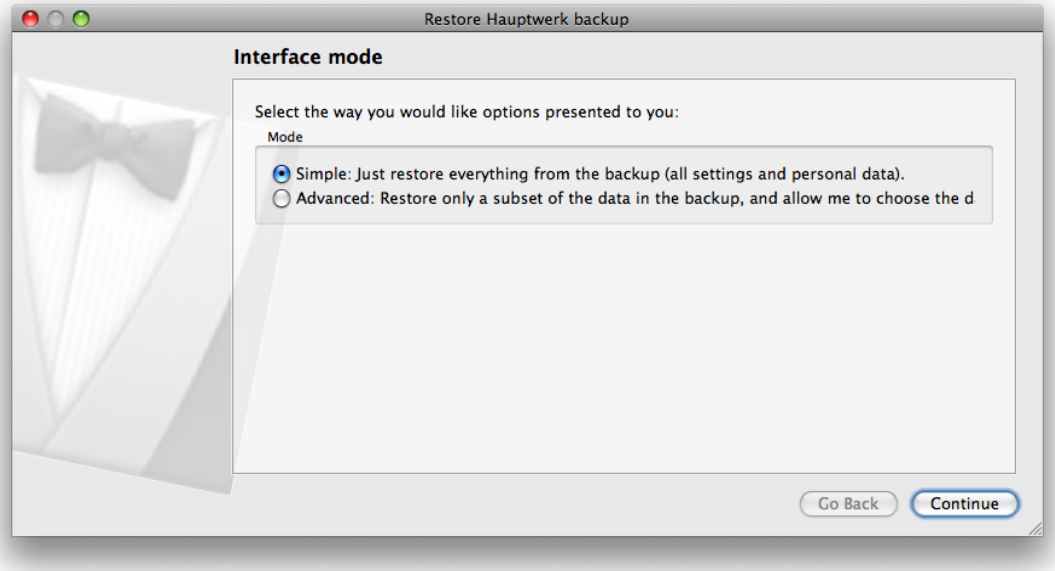
Step 3. Insert the DVD or CD containing the most recent backup you made of your Hauptwerk settings and personal data.

Step 4. Launch Hauptwerk. Select *File | Restore your current Hauptwerk settings or personal data from a backup* from the Hauptwerk menu:



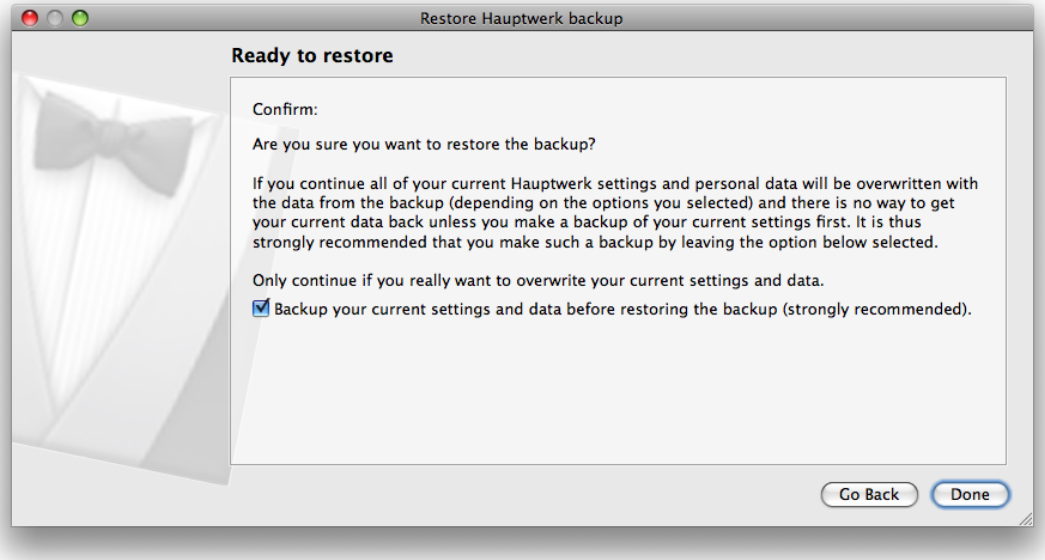
Step 5. When prompted for the file to restore, navigate to and select your backup file on your DVD or CD. Click *Open* to restore the selected backup file.

Step 6. A screen ('wizard') similar to the following should appear:



Just click the *Continue* button.

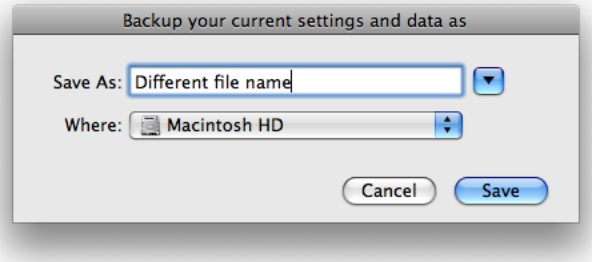
Step 7. A screen similar to the following should appear:



Just click the *Done* button, leaving the option selected to backup your current settings (which should all be at their defaults anyway, since you have only just installed Hauptwerk) for good measure.

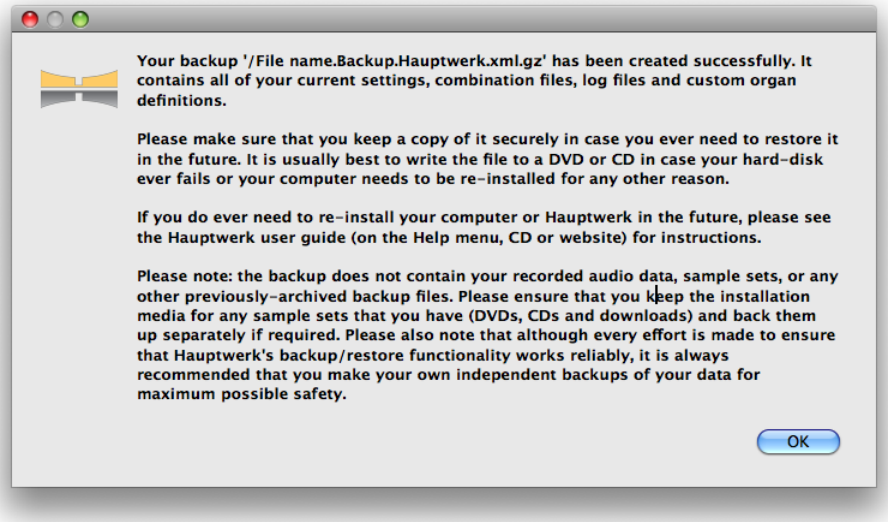
Step 8. A *Save as* window will appear. Use it to navigate to a location in which you want a backup of your current (default) settings to be created. For example, choose your desktop or your home folder (Mac OS X) or My Documents folder

(Windows). Type a meaningful name for the backup file, so that you will be able to identify and find it later, in case you ever needed to restore it, and then click the *Save* button:



Important: Please be careful **not** to select the previous file that you are currently restoring, otherwise it would be overwritten!

Step 9. After a few moments a message should appear, indicating that the backup of your current (default) settings has been created successfully, similar to this:



Click *OK*.

Step 10. Now Hauptwerk will restore the backup of your previous settings that you originally selected from your DVD or CD. After a few moments a message should appear, indicating that the backup has been restored successfully, similar to this:

Click *OK*. Hauptwerk should close unless you are using a VST/AudioUnit plug-in configuration (in which case please un-load the Hauptwerk plug-in manually).

Step 11. Launch Hauptwerk again. Hauptwerk will perform any necessary computer/configuration or platform-specific migrations automatically. Look at some of the settings screens to verify that your previous settings have now been restored properly.

Step 12. Select the appropriate audio and MIDI devices for your new computer for **all** entries in the left-hand browse lists on each of the following screens on the *General settings* menu: *Audio outputs*, *MIDI input paths* and *MIDI output paths* (Advanced Edition).

Step 13. Test and set the polyphony limit and any other performance settings for your new computer, as described in the performance tuning section.

Step 14. Re-install each third-party sample set that you have using Hauptwerk's component installer.

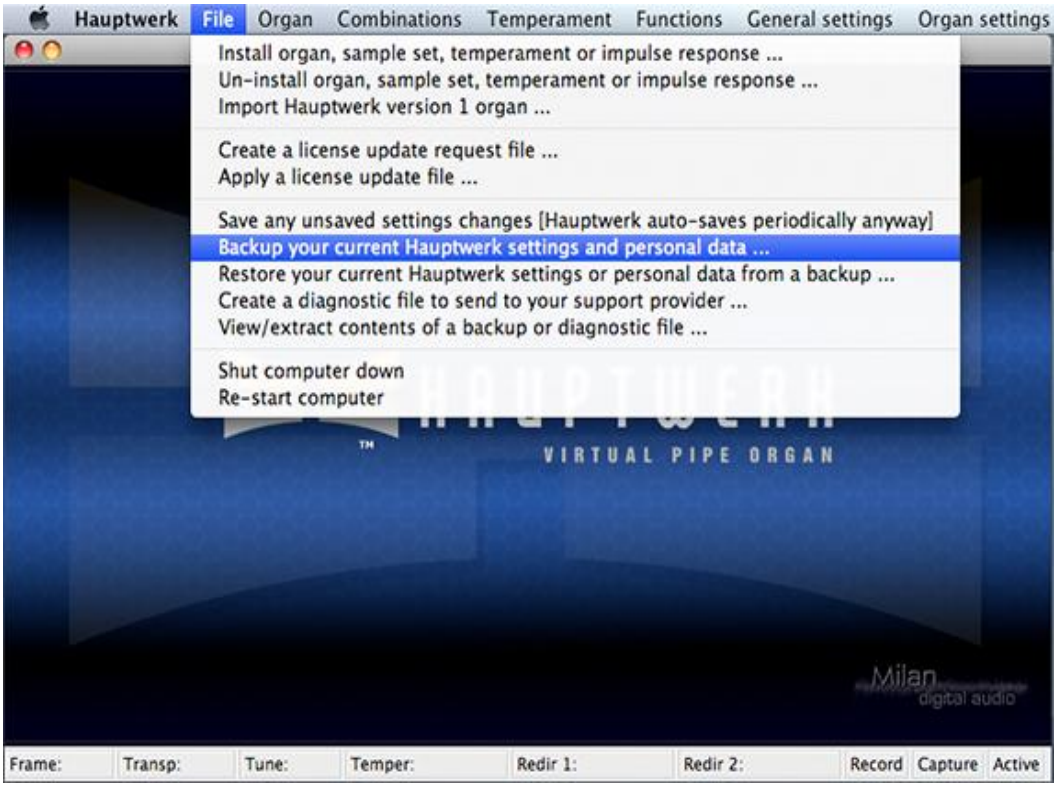
Step 15. Finally, load the sample sets and check that everything is working as expected.

Copying your settings from one configuration to another on the same computer

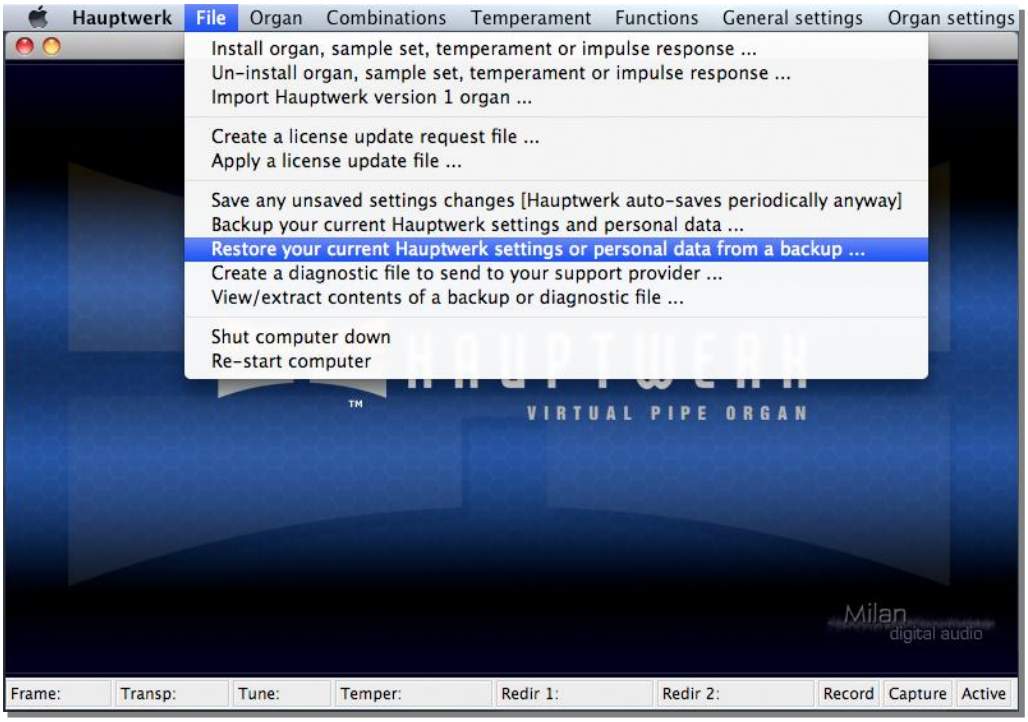
Several independent Hauptwerk configurations are automatically created when Hauptwerk is installed, each allowing its own entirely separate set of configuration settings within Hauptwerk, and launched via different icons on the desktop, such as the *Hauptwerk (stand-alone)* icon and the *Hauptwerk (for MIDI sequencing)* icon. For more information, please see the installation background section.

You can use Hauptwerk's backup/restore functionality to copy your settings from one configuration to another. To do so:

Step 1. Launch the Hauptwerk configuration that you want to copy settings to. For example, open Hauptwerk using the *Hauptwerk (stand-alone)* icon on your desktop. Create a backup of your settings and personal data using *File | Backup your current Hauptwerk settings and personal data* from the Hauptwerk menu, as described in the *How to make a backup* instructions above (although you might choose not to bother writing the backup to a DVD/CD in this case). Backups always contain data for all configurations, so you don't need to use the source configuration separately to create the backup.

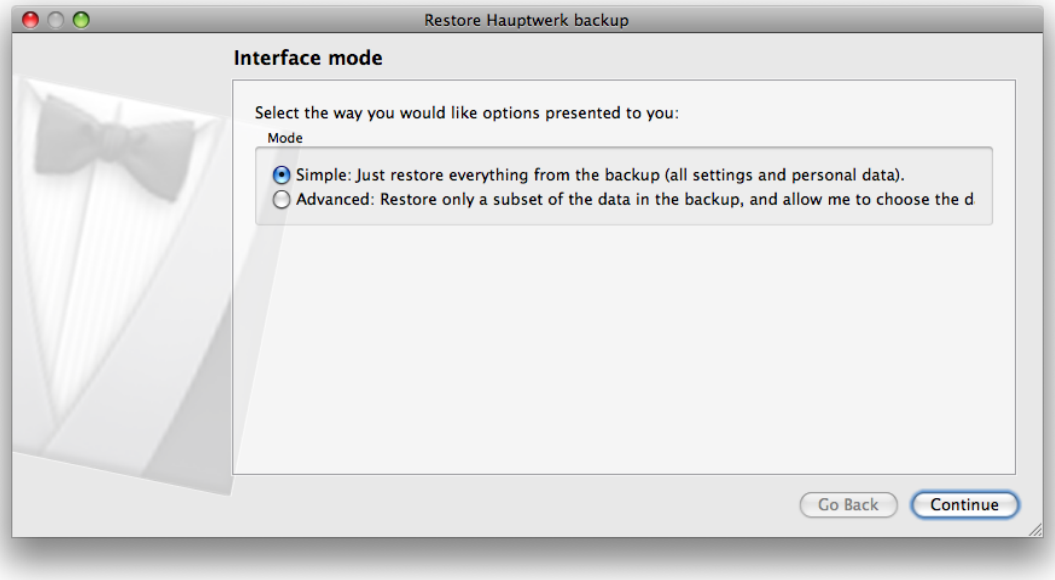


Step 2. Select *File | Restore your current Hauptwerk settings or personal data from a backup* from the Hauptwerk menu:



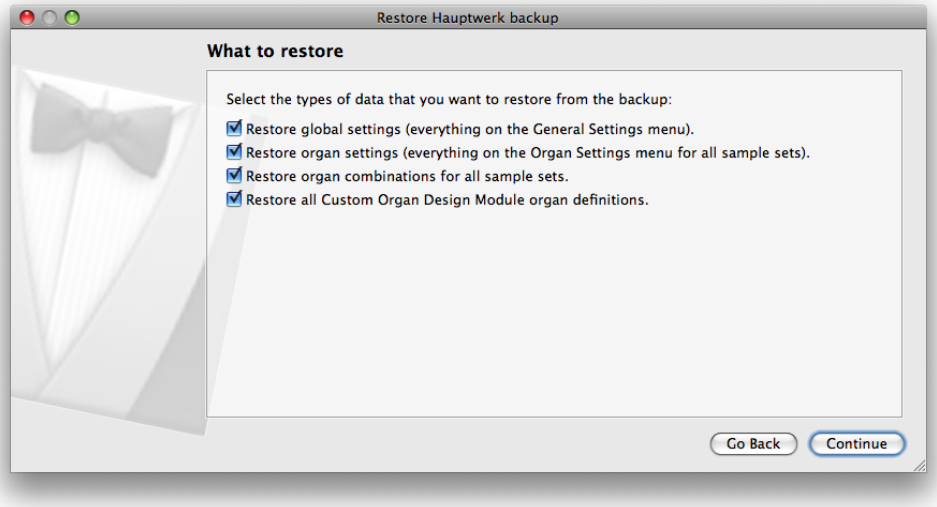
Step 3. When prompted for the file to restore, navigate to and select the backup file you created in step 1.

Step 4. A screen ('wizard') similar to the following should appear:



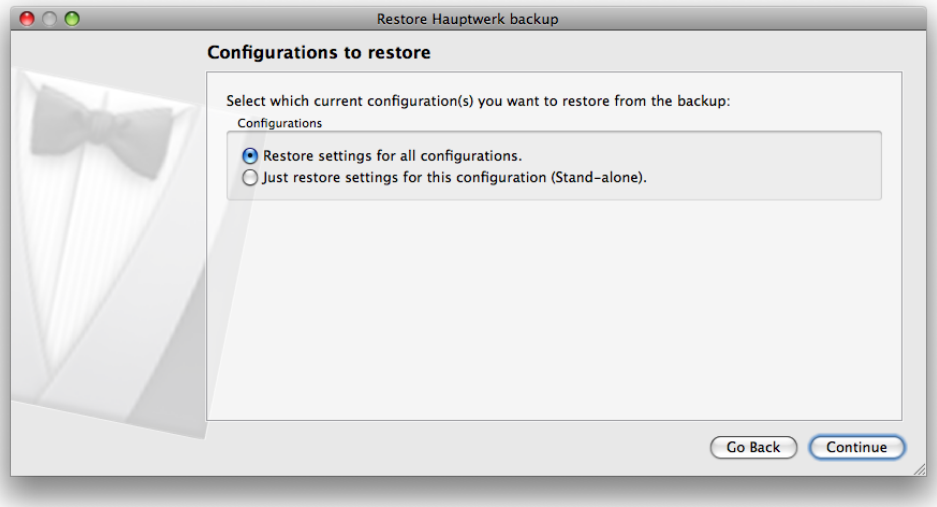
Change the mode from *Simple* to *Advanced* then click the *Continue* button.

Step 5. A screen similar to the following should appear:



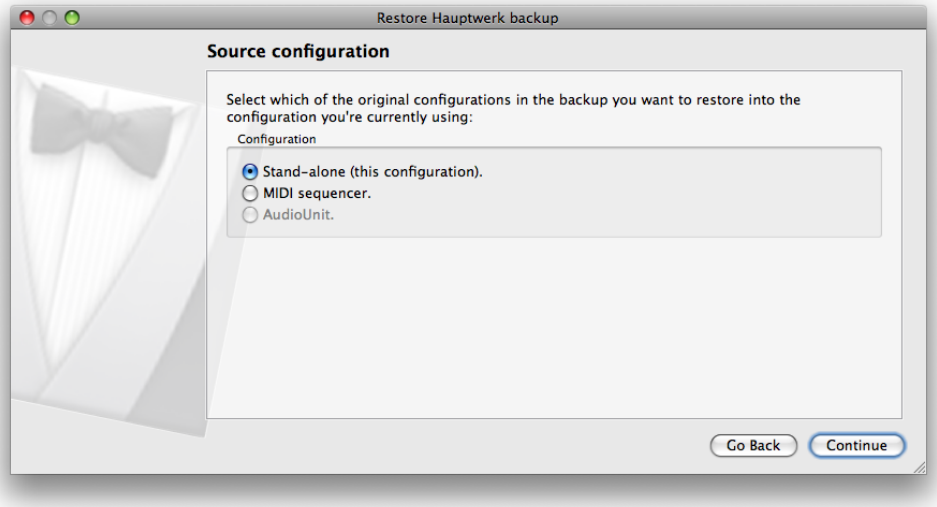
Un-tick the options *Restore organ combinations for all sample sets* and *Restore all Custom Organ Design Module organ definitions* (since those types of data are shared between all configurations anyway, so there is no need to restore them in this case), but leave the *Restore global settings (everything on the General Settings menu)* and *Restore organ settings (everything on the Organ Settings menu for all sample sets)* options ticked (since those types of data are stored separately for each configuration). Click the *Continue* button.

Step 6. A screen similar to the following should appear:



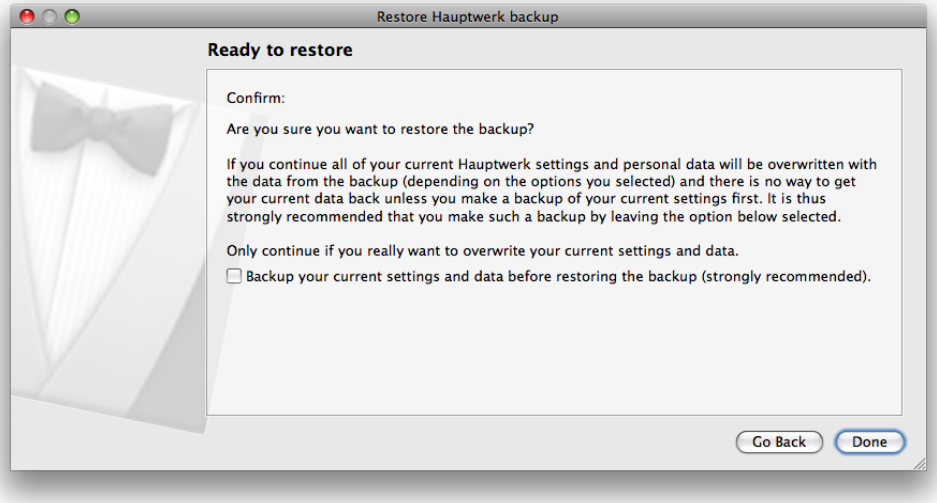
Change the selection to *Just restore settings for this configuration ...* . Click the *Continue* button.

Step 7. A screen similar to the following should appear:



Change the selection to the configuration you want to restore your settings from. Click the *Continue* button.

Step 8. A screen similar to the following should appear:



Un-tick the option to backup your current settings for good measure since you have already just made a backup in step 1. Click the *Done* button.

Step 9. Now Hauptwerk will restore the backup, copying the settings from your chosen source configuration into this configuration. After a few moments a message should appear, indicating that the backup of your has been restored successfully, similar to this:

Click *OK*. Hauptwerk should close unless you are using a VST/AudioUnit plug-in configuration (in which case please un-load the Hauptwerk plug-in manually).

Step 10. Launch the target configuration of Hauptwerk again. Hauptwerk will perform any necessary computer/configuration or platform-specific migrations automatically. Look at some of the settings screens to verify that your previous settings have now been restored properly.

Section III: Quick start

Quick-start: stand-alone configuration

Follow these instructions if you will be playing Hauptwerk 'live' from MIDI keyboards or an external MIDI organ console.

Make sure that you have followed all of the installation steps in the installation section. Make sure that your MIDI interface and audio/sound interface are properly connected to the computer and powered up, and that your Hauptwerk USB key is attached to a USB port on the computer if you have purchased a license for Hauptwerk.

Connect the audio output from your audio/sound interface to some form of external amplification, such as a hi-fi system or headphones.

Connect the MIDI output port on your MIDI keyboard or organ console to the MIDI input port on your computer using a genuine MIDI lead and any adapters that are necessary. Determine the MIDI channel on which the MIDI keyboard, or main manual of the organ console, is set to transmit, consulting the manual for the keyboard/organ if necessary.

Run the stand-alone Hauptwerk configuration by double-clicking on the *Hauptwerk (stand-alone)* icon on your desktop. If you are asked whether you would like to optimize Hauptwerk for maximum realism or performance, respond according to your preference.

The main Hauptwerk window should appear (appearances will vary a little depending on whether you are using an on Apple Mac computer or a Windows PC):

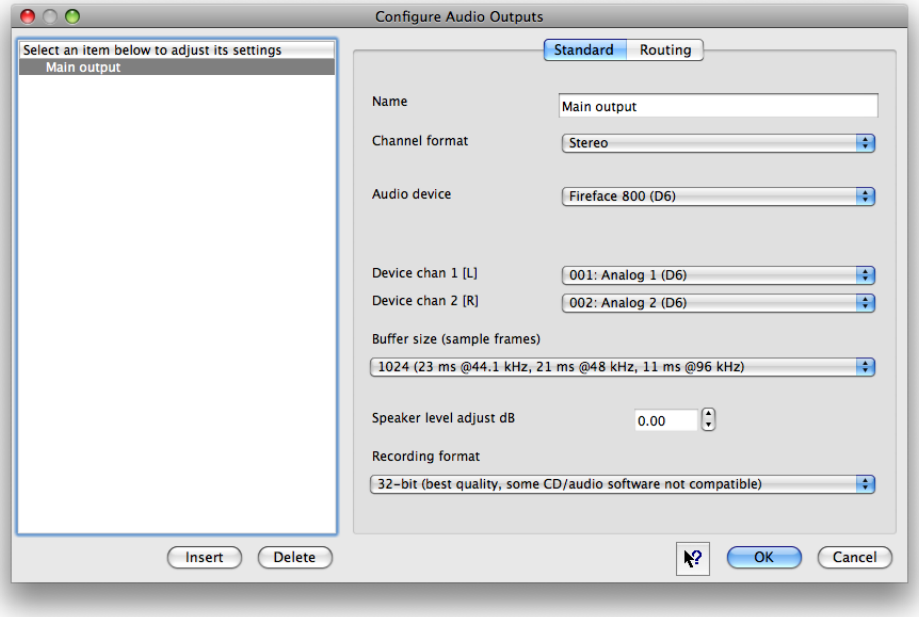
Go to *General settings | Audio outputs* from the menu. For the *Audio output device* setting, select the audio/sound interface that you have connected to the amplifier.

On Windows PCs: selecting the entry for the correct native (manufacturer-supplied) driver for your audio interface is crucial to getting good performance with Hauptwerk. A native ASIO driver is usually best if available, otherwise choose a native

DirectSound driver. The Creative series of sound cards are exceptions, since Creative's ASIO drivers are very restrictive. For Creative sound cards (only), please select Creative's DirectSound driver instead of their ASIO driver. Always avoid third-party or emulated drivers.

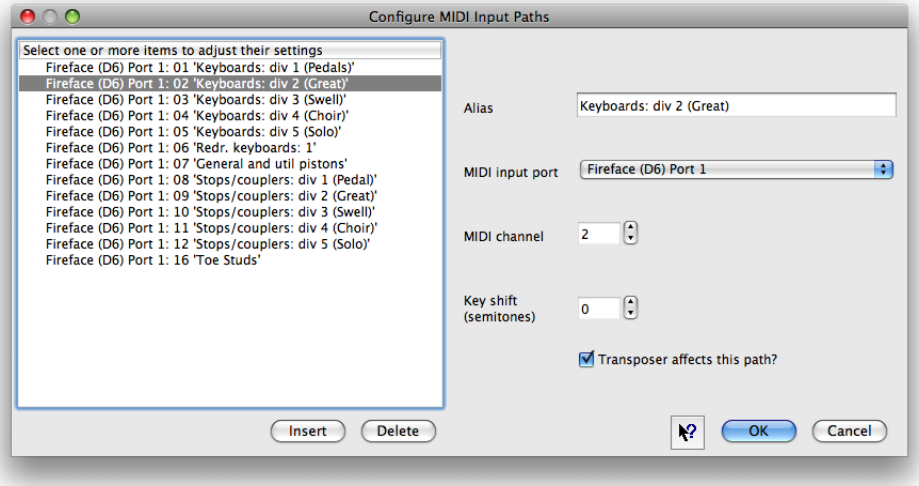
Next verify or adjust the left and right device channel settings, ensuring that the audio output connections are selected that you have connected to your amplifier.

For example:



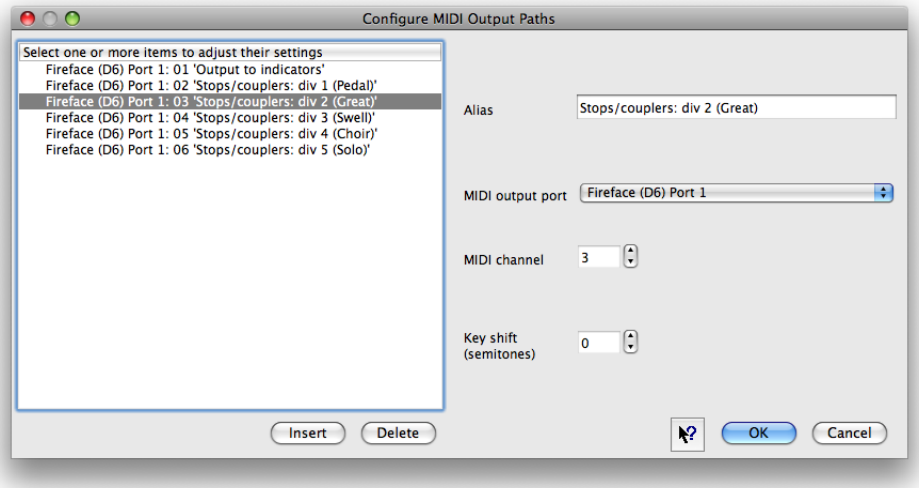
Click OK.

From the menu now choose *General settings | MIDI input paths*. In the left-hand pane, click on the '... Keyboards: div 2 (Great)' entry (each entry is prefixed with the MIDI port and channel currently selected for it for clarity). For the *MIDI input port* on the right-hand pane, choose the computer's MIDI input port to which your external MIDI keyboard or console has been connected by the MIDI cable. Also change the *MIDI channel* setting to match the channel on which the MIDI keyboard or main keyboard of the MIDI organ is set to transmit, as determined previously:



Click *OK*. If an error message appears, indicating that two MIDI input paths have the same port and channel setting, then see which MIDI other input path is shown in the message, dismiss the message, and change the MIDI input channel for that path to an unused value, then OK the screen again. For example, if the message states that the '... Keyboards: div 2 (Great)' and '... Keyboards: div 3 (Swell)' have matching port and channel settings, then select the '... Keyboards: div 3 (Swell)' entry in the left-hand pane, and change its channel number in the right-hand pane.

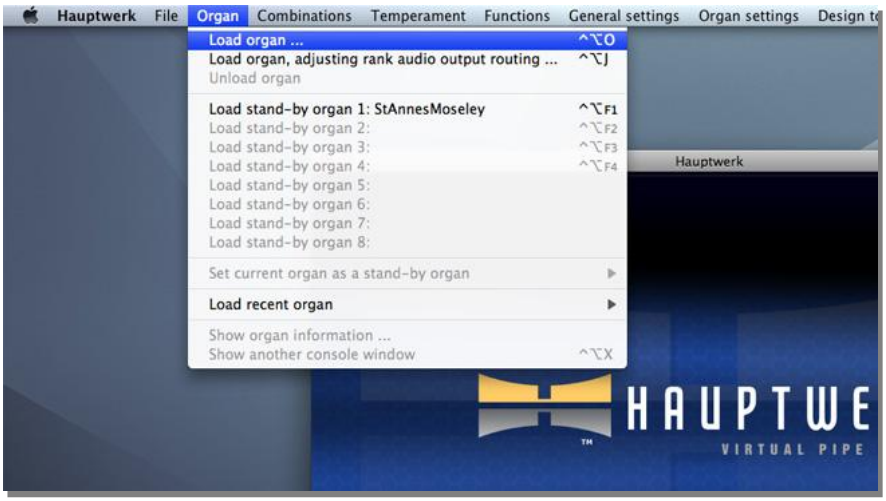
If you are using or evaluating the Advanced Edition of Hauptwerk, from the menu choose *General settings | MIDI output paths*. With the first entry selected in the left-hand browse list, for now ensure that its *MIDI output port* is set to a 'real' MIDI port that has no external MIDI hardware attached to it, and not to a software or hardware synthesizer (otherwise the synthesizer may be triggered when you change registration or play Hauptwerk). Repeat for each entry in the left-hand browse list:



Click *OK*.

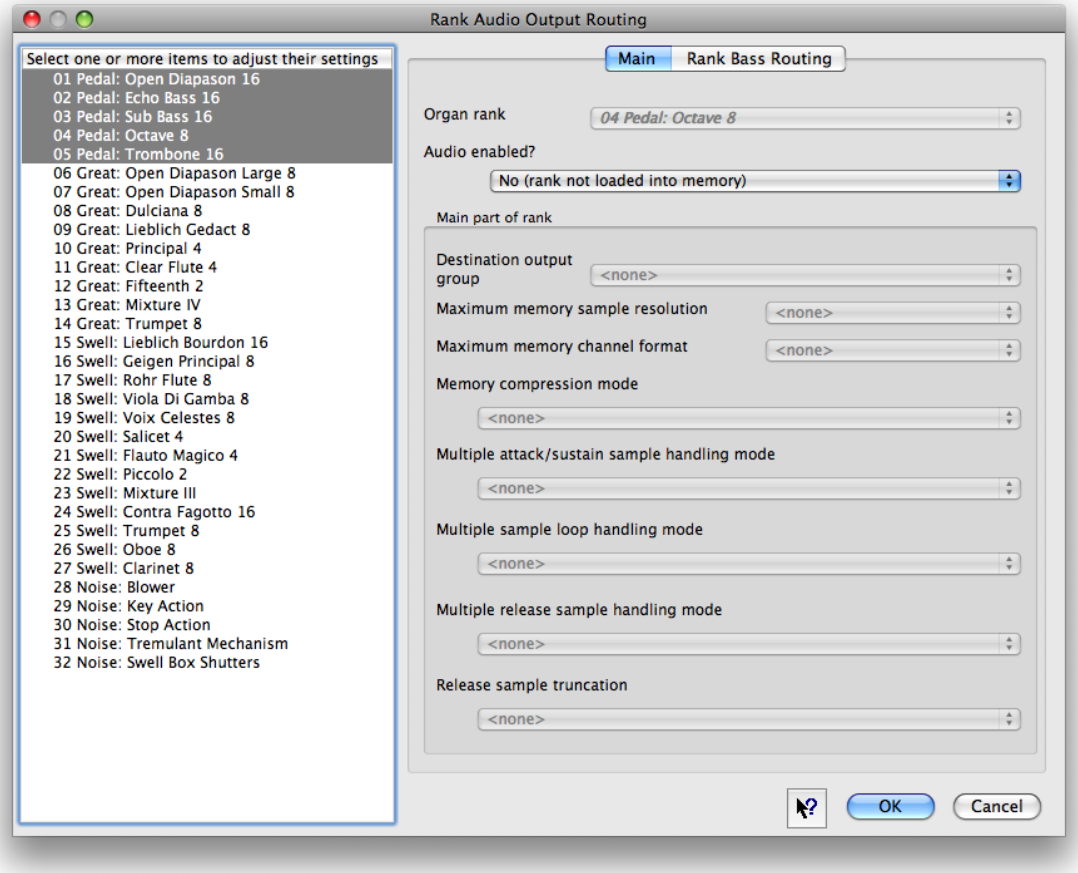
Sufficient configuration has now been performed to allow a sample set to be loaded and played from a single keyboard.

From the menu, choose *Organ* | *Load organ*:



For the majority of audio interfaces, click on the *StAnnesMoseley* entry, then click *OK*. If, however, you are using a Creative Audigy interface in ASIO mode (not recommended) on a Windows PC, or another interface whose driver has a locked sample rate of 48 kHz, instead click on the *StAnnesMoseley-ForLocked48kHzDrivers* entry and click *OK*. After a brief pause a screen entitled *Rank Audio Output Routing* should appear.

If you have at least 1 GB of memory installed in the computer, simply click *OK*. If not, assuming you have 512 MB of installed memory (the minimum required), select each Swell and Pedal rank in the left-hand list (you can select multiple entries at once), and change their *Audio enabled?* settings to 'No', repeat for the Noise 'ranks' (so that only the Great ranks remain enabled), then click *OK*:



The sample set should now load, which may take a few minutes, depending on the speed of your computer. The first time that a sample set is loaded, analysis and processing of the sample set data are performed, the results of which are saved to a special 'sample set data cache', so that each subsequent load is many times faster. However, if you change certain audio routing settings or general settings, Hauptwerk might need to perform such processing again to reflect the changes. This happens automatically when required. Options that cause regeneration of the sample set caches are clearly identified on the settings screens, and there are very few. Changing per-rank options via *Organ | Load organ, adjusting rank audio output routing* also causes the sample set data cache to be regenerated for the selected sample set.

As soon as the sample set has finished loading, Hauptwerk will automatically attempt to start the audio and MIDI drivers/interfaces. If any errors occur relating to unsupported audio formats or sample rates, change the audio device selected on the *General settings* | *Audio outputs* screen, and adjust the audio channel configuration as necessary. Once the audio and MIDI systems are activated successfully, the St. Anne's organ console should appear:

Click on the 'OPEN DIAPASON LARGE 8' stop on the right-hand side of the console to engage it.

Now click on a key on the lower of the two virtual manuals (keyboards), and hold it down. You should be able to hear the corresponding pipe sounding. If not, check the audio connections, that the amplifier is turned up, and, if necessary, check the settings on the *General settings* | *Audio output* screen.

If the sound is breaking up or crackling whenever any pipe sounds, then first of all check that the audio connections and wiring are good. If so, with the sample set still loaded, go to *General settings* | *Audio output*. Try larger audio buffer size settings. The buffer size setting determines the delay between pressing a key and hearing the sound, termed the latency. Buffer sizes in the region of 1024 samples (the default) usually work well, but you can certainly use smaller buffer sizes to give a faster response (lower latency) if your hardware supports it, usually at the expense of a little polyphony. Most professional audio interfaces can manage a buffer size of 512 samples without a significant reduction in polyphony.

On Windows PCs: some DirectSound drivers work well with certain specific small buffer sizes but not others. In general, manufacturer-supplied ASIO drivers, which are almost always available on professional audio interfaces, are to be preferred. Note also that some ASIO drivers only allow the buffer size to be adjusted via the manufacturer-supplied ASIO control panel. If Hauptwerk's buffer size setting is having no effect, click on the *Show device control panel* button and try adjusting the buffer size there.

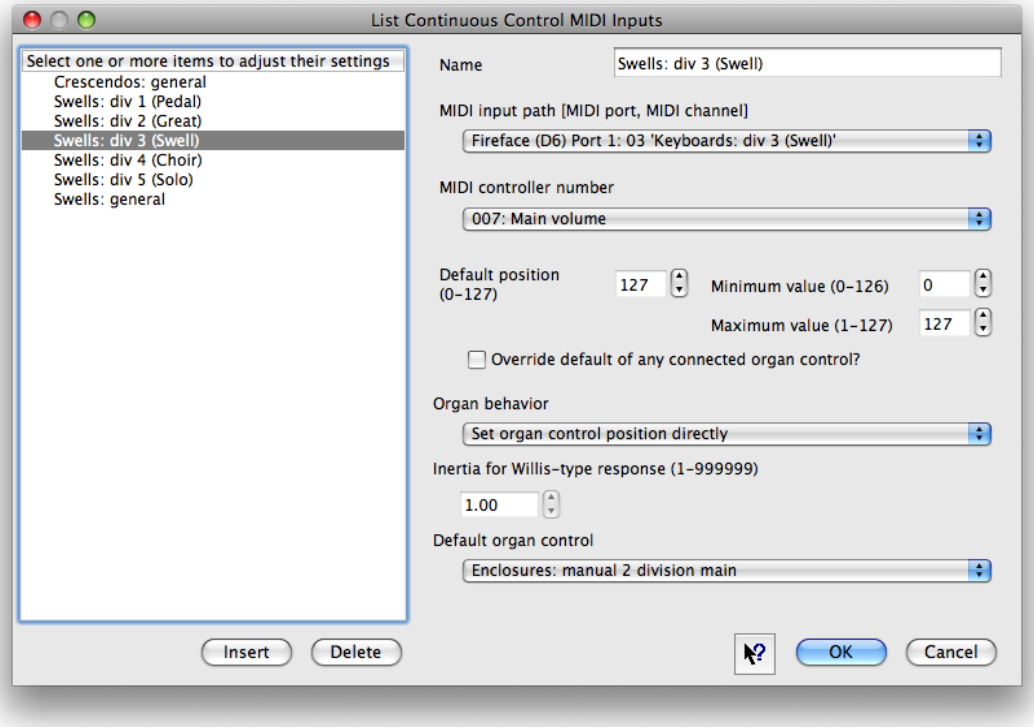
Note that the driver and the buffer size setting determine the latency, rather than Hauptwerk itself.

Once you can hear the pipe correctly, release the virtual key, and try playing a key on your MIDI keyboard or the main manual of your MIDI organ console. If the MIDI connections and configuration are correct, you should see the virtual key responding, and hear the corresponding pipe. If not, check that the port and channel is specified correctly on the *General settings | MIDI input paths* screen. Also check the MIDI connections and wiring, and the MIDI output channel of your MIDI keyboard or organ.

If you only have one MIDI keyboard, then the basic configuration is complete, and you are ready to use Hauptwerk.

If you have more MIDI keyboards or a MIDI pedalboard, use the *General settings | MIDI input paths* screen to configure the MIDI input ports and channels appropriately for the corresponding '... Keyboards: ...' entries listed in the left-hand pane.

If you have any MIDI continuous controller pedals, such as MIDI swell/expression pedals, with which you wish to control Hauptwerk's virtual swell and crescendo pedals, then go to *General settings | Continuous control MIDI inputs* from the menu. If you have a pedal that you wish to use as a swell pedal, select the 'Swells: div 3 (Swell)' entry in the left-hand pane:



Set the MIDI controller number to match the controller sent by the pedal. The most common controller numbers are:

- 1 - Modulation wheel.
- 4 - Foot controller.
- 6 - Data entry control.
- 7 - Main volume.
- 11- Expression.

If the MIDI pedal is connected to the same MIDI input port on the computer as one of the MIDI keyboards (e.g. with a MIDI merge box), and has the same MIDI channel as the keyboard, then choose the entry for that keyboard in the MIDI input

path list. If not, you will need to go back to the *General settings | MIDI input paths* screen, and create a new path by clicking the *Insert* button for the combination of MIDI port and channel, finally returning to the *General settings | Continuous control MIDI inputs* screen to select it for the swell pedal.

If you have a MIDI pedal to use as a crescendo pedal, again using the *General settings | Continuous control MIDI inputs* screen, select the 'Crescendos: general' entry in the left-hand pane and select the MIDI input path (creating a new one, as for the swell pedal, if necessary) and controller number.

If you have configured a swell or crescendo pedal, try moving the MIDI pedals. The corresponding virtual pedals on the screen should now move.

Finally, please now make a backup of your Hauptwerk settings and data following the step-by-step 'How to make a backup' instructions in the backups section of the guide. Doing so should allow you to get your current settings back in case your computer ever needs to be re-installed in the future.

For more detailed information on how to use and configure Hauptwerk's MIDI settings, please consult the MIDI input section.

Quick-start: MIDI sequencing configuration

Follow these instructions if you will be playing Hauptwerk from a software MIDI sequencer and you are using an Apple Mac, or you are using a Windows PC but your sequencer does not accept VST instrument plug-ins.

Make sure that you have followed all of the installation steps in the installation section. In particular, make sure that you enabled the IAC Driver if you are using an Apple Mac, or installed MIDI Yoke (32-bit Hauptwerk only) or LoopBe (32-bit or 64-bit Hauptwerk) if you are using a Windows PC. Make sure that your MIDI interface and audio/sound interface are properly connected to the computer and powered up, and that your Hauptwerk USB key is attached to a USB port on the computer if you have purchased a license for Hauptwerk.

Connect the audio output from your audio/sound interface to some form of external amplification, such as a hi-fi system or headphones.

Now run the MIDI sequencer Hauptwerk configuration by double-clicking on the *Hauptwerk (MIDI sequencing)* icon on your desktop. If you are asked whether you would like to optimize Hauptwerk for maximum realism or performance, respond according to your preference.

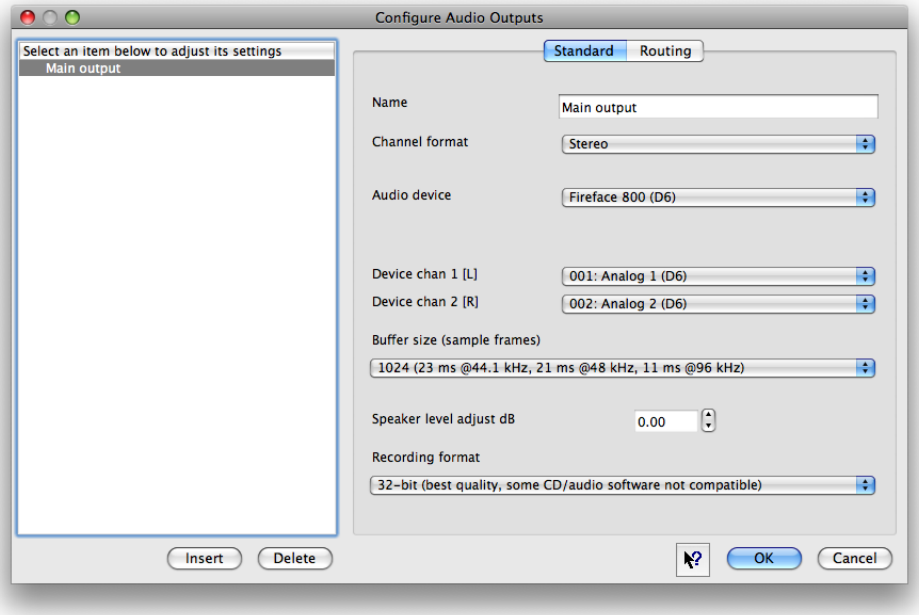
The main Hauptwerk window should appear (appearances will vary a little depending on whether you are using an on Apple Mac computer or a Windows PC):

Go to *General settings | Audio outputs* from the menu. For the *Audio output device* setting, select the audio/sound interface that you have connected to the amplifier.

On Windows PCs: selecting the entry for the correct native (manufacturer-supplied) driver for your audio interface is crucial to getting good performance with Hauptwerk. A native ASIO driver is usually best if available, otherwise choose a native DirectSound driver. The Creative series of sound cards are exceptions, since Creative's ASIO drivers are very restrictive. For Creative sound cards (only), please select Creative's DirectSound driver instead of their ASIO driver. Always avoid third-party or emulated drivers.

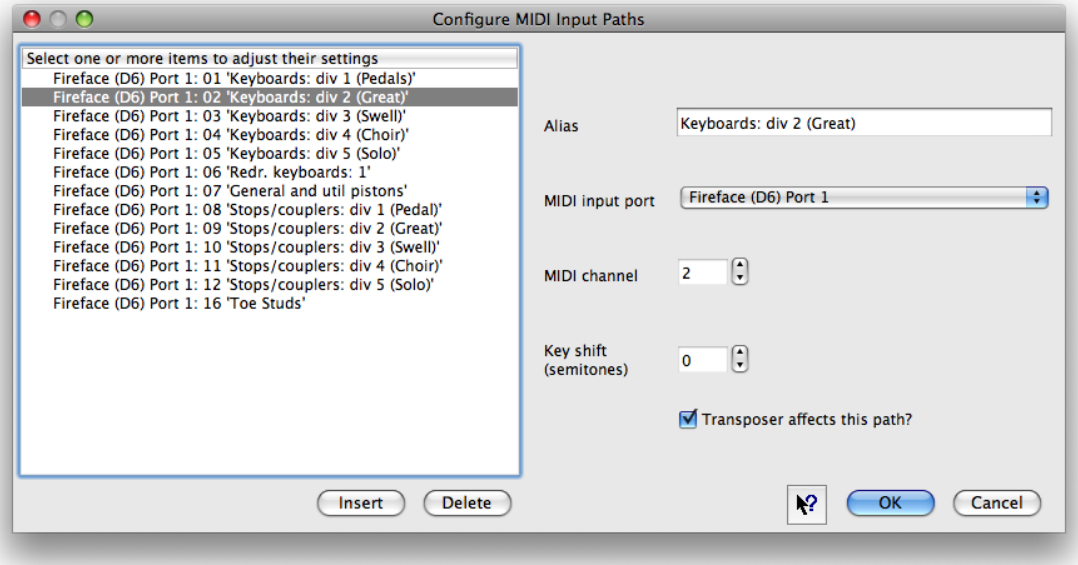
Next verify or adjust the left and right device channel settings, ensuring that the audio output connections are selected that you have connected to your amplifier.

For example:



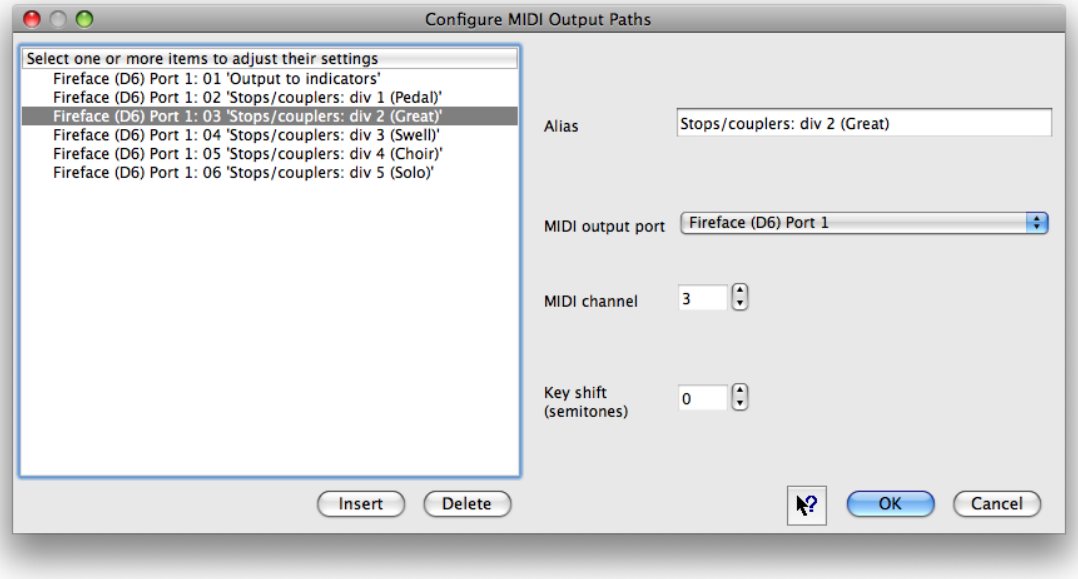
Click *OK*.

From the menu now choose *General settings | MIDI input paths*. Select the first path in the left-hand pane: '... General and util pistons' (each entry is prefixed with the MIDI port and channel currently selected for it for clarity). In the right-hand pane, ensure that the MIDI input port is set to the first virtual MIDI cable. On an Apple Mac the first virtual MIDI cable will be called 'IAC Driver Bus 1', whereas on a Windows PC it will probably be 'MIDI Yoke NT: 1' or 'LoopBe Internal MIDI', depending on the virtual MIDI cable software you have installed. Repeat for each of the paths in the left-hand pane, setting them all to use the first virtual MIDI cable:



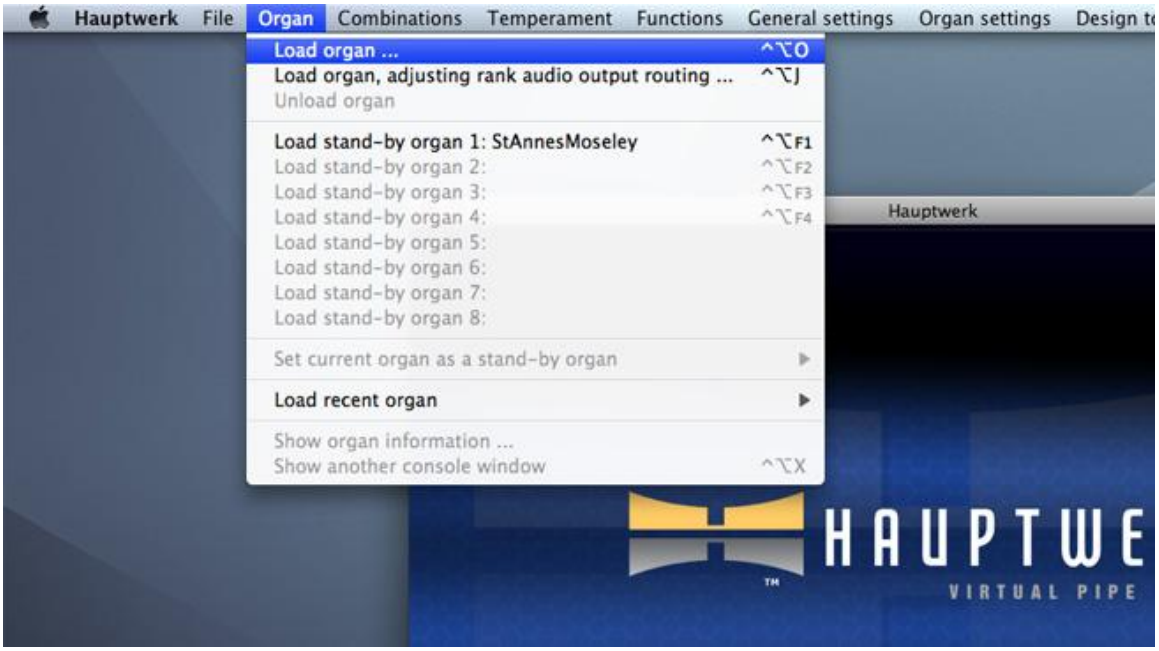
Click *OK*.

If you are using or evaluating the Advanced Edition of Hauptwerk, from the menu choose *General settings | MIDI output paths*. With the first entry selected in the left-hand browse list, for now ensure that its *MIDI output port* on the right-hand pane is set to a 'real' MIDI port that has no external MIDI hardware attached to it, and not to a software or hardware synthesizer (otherwise the synthesizer may be triggered when you change registration or play Hauptwerk). Repeat for each entry in the left-hand browse list:



Click *OK*.

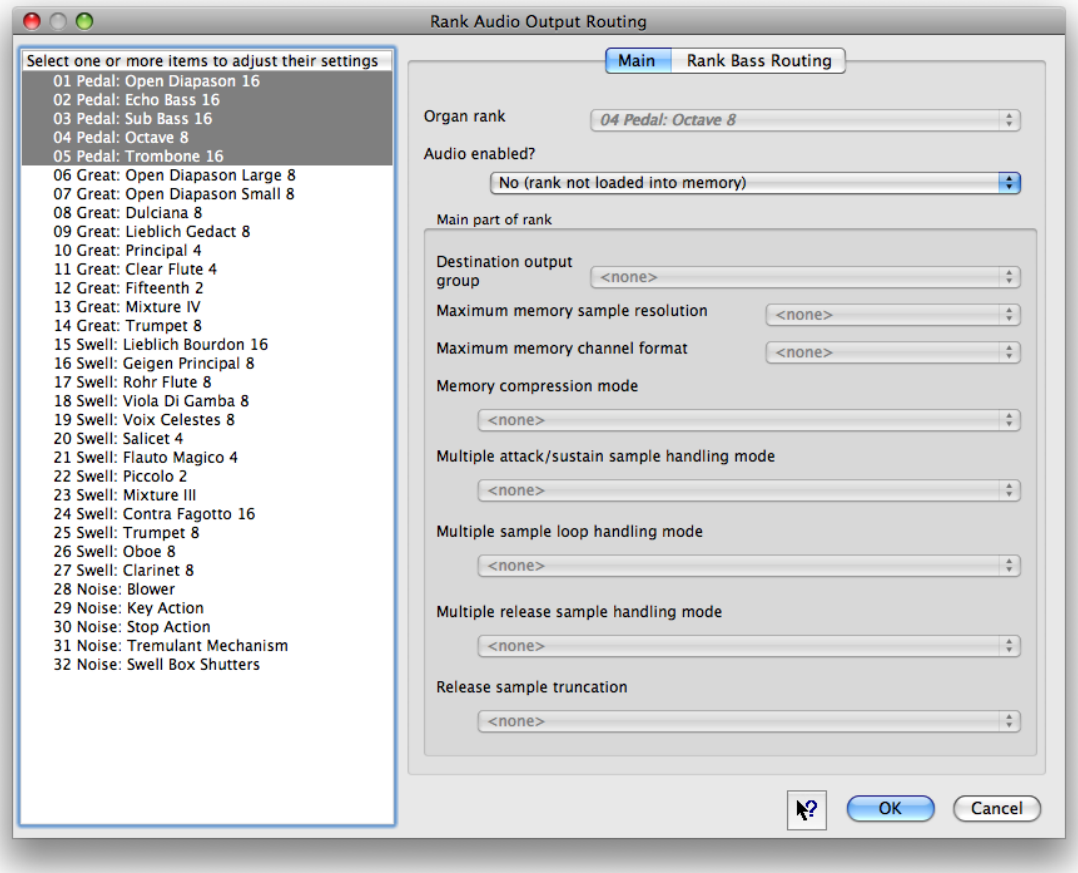
From the menu, choose *Organ | Load organ*:



For the majority of audio interfaces, click on the *StAnnesMoseley* entry, then click *OK*. If, however, you are using a Creative

Audigy interface in ASIO mode (not recommended) on a Windows PC, or another interface whose driver has a locked sample rate of 48 kHz, instead click on the *StAnnesMoseley-ForLocked48kHzDrivers* entry and click *OK*. After a brief pause a screen entitled *Rank Audio Output Routing* should appear.

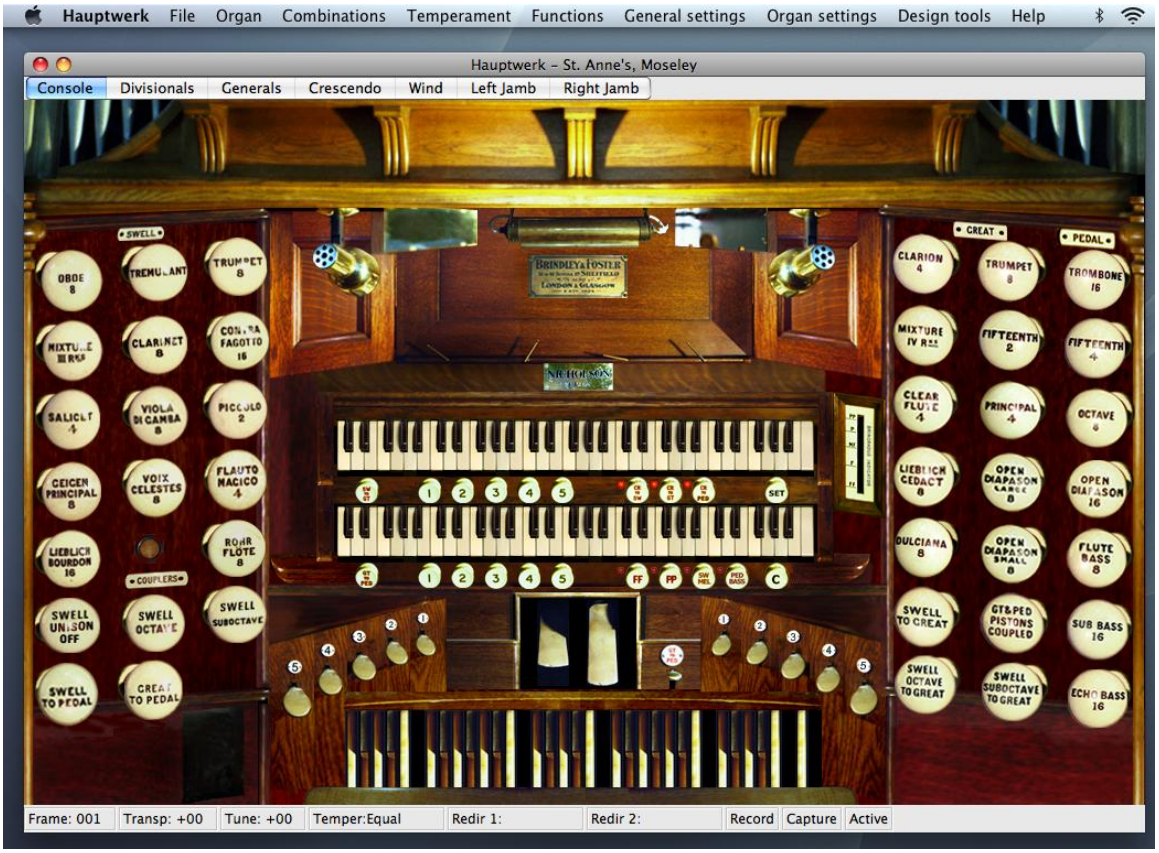
If you have at least 1 GB of memory installed in the computer, simply click *OK*. If not, assuming you have 512 MB of installed memory (the minimum required), select each Swell and Pedal rank in the left-hand list (you can select multiple entries at once), and change their *Audio enabled?* settings to 'No', repeat for the Noise 'ranks' (so that only the Great ranks remain enabled), then click *OK*:



The sample set should now load, which may take a few minutes, depending on the speed of your computer. The first time that a sample set is loaded, analysis and processing of the sample set data are performed, the results of which are saved to a special 'sample set data cache', so that each subsequent load is many times faster. However, if you change certain audio routing settings or general settings, Hauptwerk might need to perform such processing again to reflect the changes. This happens automatically when required. Options that cause regeneration of the sample set caches are clearly identified on the settings screens, and there are very few. Changing per-rank options via *Organ | Load organ, adjusting rank audio output routing* also causes the sample set data cache to be regenerated for the selected sample set.

As soon as the sample set has finished loading, Hauptwerk will automatically attempt to start the audio and MIDI drivers/interfaces. If any errors occur relating to unsupported audio formats or sample rates, change the audio device selected on the *General settings | Audio outputs* screen, and adjust the audio channel configuration as necessary.

Once the audio and MIDI systems are activated successfully, the St. Anne's organ console should appear:



Click on the 'OPEN DIAPASON LARGE 8' stop on the right-hand side of the console to engage it.

Now click on a key on the lower of the two virtual manuals (keyboards), and hold it down. You should be able to hear the corresponding pipe sounding. If not, check the audio connections, that the amplifier is turned up, and, if necessary, check the settings on the *General settings | Audio output* screen.

If the sound is breaking up or crackling whenever any pipe sounds, then first of all check that the audio connections and wiring are good. If so, with the sample set still loaded, go to *General settings | Audio output*. Try larger audio buffer size settings. The buffer size setting determines the delay between pressing a key and hearing the sound, termed the *latency*. Buffer sizes in the region of 1024 samples (the default) usually work well, but you can certainly use smaller buffer sizes to give a faster response (lower latency) if your hardware supports it, usually at the expense of a little polyphony. Most professional audio interfaces can manage a buffer size of 512 samples without a significant reduction in polyphony.

On Windows PCs: some DirectSound drivers work well with certain specific small buffer sizes but not others. In general, manufacturer-supplied ASIO drivers, which are almost always available on professional audio interfaces, are to be preferred. Note also that some ASIO drivers only allow the buffer size to be adjusted via the manufacturer-supplied ASIO control panel. If Hauptwerk's buffer size setting is having no effect, click on the *Show device control panel* button and try adjusting the buffer size there.

Note that the driver and the buffer size setting determine the latency, rather than Hauptwerk itself.

Now run your MIDI sequencer program.

IMPORTANT: in the sequencer program's settings make sure that **only** your virtual MIDI cable port(s) are enabled as MIDI output(s) but that the **virtual MIDI cable port(s) are disabled as MIDI input(s)**. Failing to do this is likely to give MIDI feedback, which is likely to lead crashes, freezes or strange effects such as notes or stops turning each other on/off, or to lead to Hauptwerk and the sequencer program trying to use a given MIDI port at the same time, and thus giving an error message.

In the sequencer program now set the output from a track to the first virtual MIDI cable ('IAC Driver Bus 1' on an Apple Mac or 'MIDI Yoke NT: 1' or 'LoopBe Internal MIDI' on a Windows PC) and the MIDI channel to 2 (which is the default channel for the 'Keyboards: div 2 (Great)' MIDI input path). Ensuring that a non-disabled stop is still engaged on the Great division (such as the Great Open Diapason Large 8), record and play back some notes on the sequencer track. You should see Hauptwerk's virtual keys respond and hear the Hauptwerk virtual pipes sound. If not, check that the same virtual MIDI cable is selected both in Hauptwerk and the sequencer, and that the channels match in both cases. You may possibly need to close Hauptwerk and load the sequencer program before loading the sample set in Hauptwerk.

Once you have one track controlling Hauptwerk's virtual Great keyboard, you can create others to control other virtual manuals. In each case, you simply need to select the first virtual MIDI cable, and choose the MIDI channel to match the channel for Hauptwerk's corresponding MIDI input paths. With the initial default configuration (assuming you haven't re-assigned any MIDI channels with the *MIDI input paths* screen), the MIDI channels are:

- Keyboards: div 1 (Pedals) - 1.
- Keyboards: div 2 (Great) - 2.
- Keyboards: div 3 (Swell) - 3.
- Keyboards: div 4 (Choir) - 4.
- Keyboards: div 5 (Solo) - 5.

Hauptwerk's swell and crescendo pedals can be controlled by inserting MIDI continuous controller messages in a track in the MIDI sequencer, with the track's output set to the first virtual MIDI cable, and choosing the MIDI channel and continuous controller to match those of the MIDI input path and continuous controller selected for Hauptwerk's *General settings | Continuous control MIDI inputs* screen. With the initial default configuration (assuming you haven't re-assigned any MIDI channels with the *MIDI input paths* screen, or continuous controller numbers with the *Continuous control MIDI inputs*), the channels and controllers for Hauptwerk's swell and crescendo pedals are as follows:

- Crescendos: general - channel 7, controller number 2 (breath control).
- Swells: div 1 (Pedal) - channel 1, controller number 1 (modulation wheel).
- Swells: div 2 (Great) - channel 2, controller number 1 (modulation wheel).
- Swells: div 3 (Swell) - channel 3, controller number 1 (modulation wheel).
- Swells: div 4 (Choir) - channel 4, controller number 1 (modulation wheel).
- Swells: div 5 (Solo) - channel 5, controller number 1 (modulation wheel).
- Swells: general - channel 7, controller number 1 (modulation wheel).

For further information, including the MIDI messages you should insert into sequencer tracks to control virtual draw-knobs, pistons and other virtual organ controls, please see the using Hauptwerk: MIDI sequencing section. For more detailed information on how to use and configure Hauptwerk's MIDI settings in general, please also consult the MIDI input section.

Finally, please now make a backup of your Hauptwerk settings and data following the step-by-step 'How to make a backup' instructions in the backups section of the guide. Doing so should allow you to get your current settings back in case your computer ever needs to be re-installed in the future.

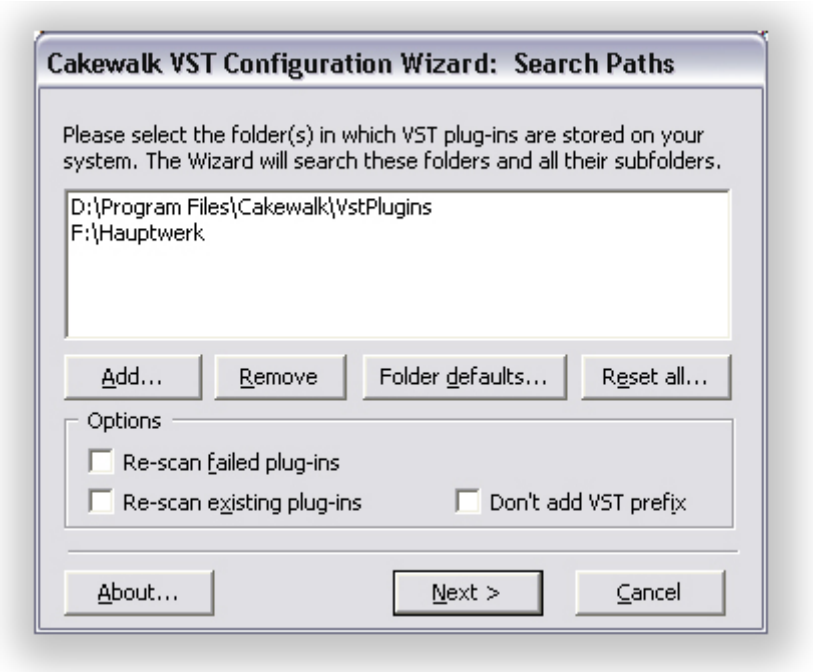
Quick-start: VSTi plug-in configuration

Follow these instructions if you will be using Hauptwerk on a Windows PC from within software that accepts VST instrument plug-ins, such as Steinberg V-STack, Steinberg Cubase or Cakewalk Sonar. Such software is termed a 'VST host'. For the purposes of this section, we will illustrate the steps using Sonar 7. The processes should be fairly similar for other VST host software or other versions. Note that only one instance of the Hauptwerk VST plug-in is allowed to be used at any one time.

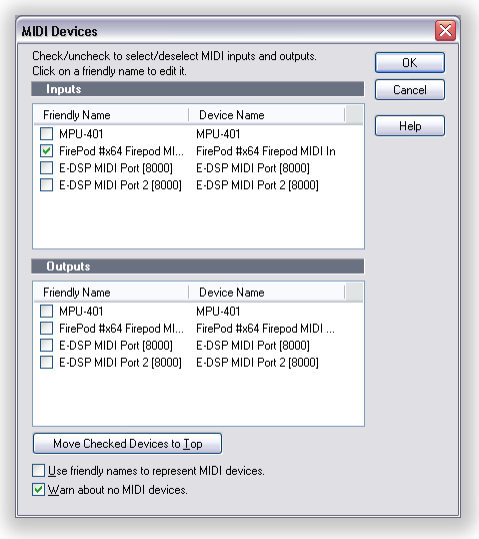
Please also note that there is not yet a plug-in version of Hauptwerk for the Apple Mac, bit we plan to add one soon. However, Audio Hijack Pro can be used to apply reverb/convolver plug-ins very easily to Hauptwerk's audio output in real-time. Note that it is also possible to use the third-party freeware Jack OS X utility to route audio output from Hauptwerk into an audio sequencer or software effects processor in real-time. However, it is quite technical and we think some less-experienced computer users might find it complex to configure.

Make sure that Hauptwerk is installed. Make sure that your MIDI interface and audio/sound interface are properly installed in the computer, their drivers are working and, on Windows systems, that you have the latest version of DirectX installed and working.

When you installed Hauptwerk you would have been prompted for the folder in which you wanted the Hauptwerk VST plug-in installed. If you selected a folder other than the default VST plug-ins folder for your VST host, then you might need to add Hauptwerk's VST plug-in folder to the VST host's plug-ins search path, so that the host can find the Hauptwerk plug-in. To change Sonar's plug-ins search path use *Tools* | *VST Configuration Wizard* from the Sonar menu. You might need to re-start the VST host software if you change its plug-ins search path:



Make sure that your VST host program is properly installed and configured, and is producing sound properly. The most important settings are that the MIDI input ports to which you will be connecting external MIDI keyboards are active (enabled) from the *Inputs* list of the *Options* | *MIDI Devices* screen in Sonar:



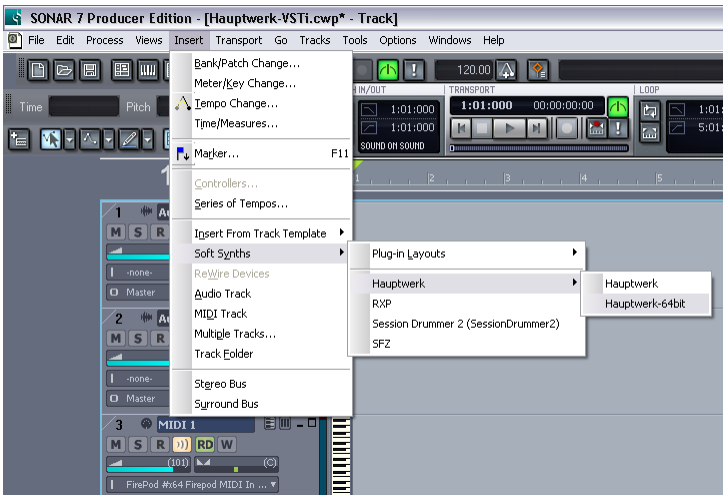
You also need to select the audio output device that the VST host will use. In Sonar select *Options | Audio*. If you have an audio/sound interface that has ASIO drivers then select it for the *ASIO Driver* setting. Avoid an 'ASIO DirectX' driver and

'ASIO Multimedia Driver' entry if there is another entry specifically for your interface. For example, for the PreSonus Firepod audio card, choose the 'FirePod ASIO' entry:

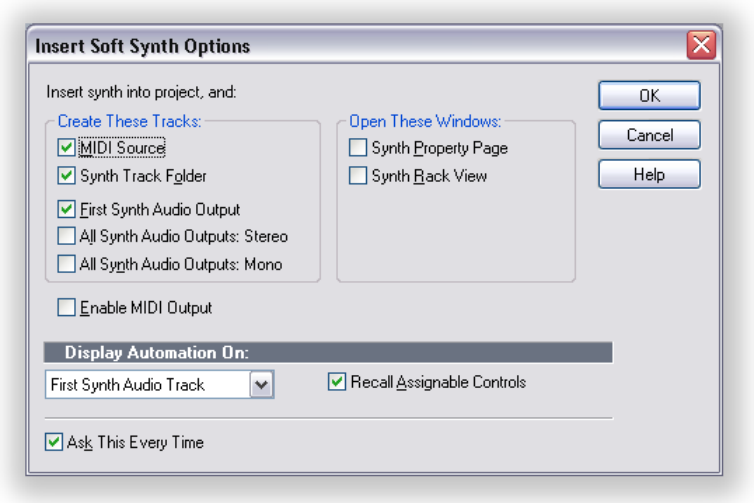
If your audio/sound interface does not have true ASIO drivers, instead select the 'ASIO DirectX Full Duplex Driver'.

If you are using Cakewalk Sonar as your VST host software, then please make sure that Sonar's multi-processor engine is not enabled (on the *Options | Audio ... | Advanced* tab in Sonar 6.2). Sonar's multi-processor engine is not needed since Hauptwerk has its own multi-processor optimization, and the two conflict (causing distorted audio) unless Sonar's is disabled.

Now select Hauptwerk as an instrument for a VSTi plug-in. In Sonar, this achieved by clicking on *Insert | Soft Synths | Hauptwerk | Hauptwerk* (64 bit if using a 64 bit operating system):



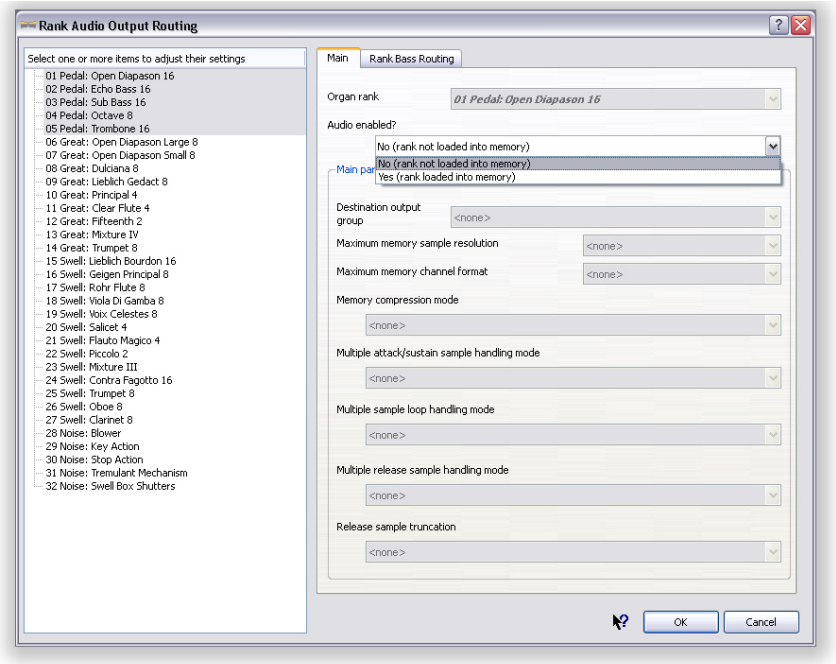
Choose the options you would like to have available:



Now Hauptwerk will launch as a VSTi plug in.

From the menu, choose *Organ | Load organ*. For the majority of audio/sound cards, click on the *StAnnesMoseley* entry, then click *OK*. If, however, you are using a Creative Audigy card in ASIO mode (not recommended), or another interface whose driver has a locked sample rate of 48 kHz, instead click on the *StAnnesMoseley-ForLocked48kHzDrivers* entry and click *OK*. After a brief pause a screen entitled *Rank Audio Output Routing* should appear.

If you have at least 1 GB of memory installed in the computer, simply click *OK*. If not, assuming you have 512 MB of installed memory (the minimum required), select each Swell and Pedal rank in the left-hand list (you can select multiple entries at once), and change their *Audio enabled?* settings to 'No', repeat for the Noise 'ranks' (so that only the Great ranks remain enabled), then click *OK*:



The sample set should now load, which may take a few minutes, depending on the speed of your computer. The first time that a sample set is loaded, analysis and processing of the sample set data are performed, the results of which are saved to a special 'sample set data cache', so that each subsequent load is many times faster. However, if you change certain audio routing settings or general settings, Hauptwerk might need to perform such processing again to reflect the changes. This happens automatically when required. Options that cause regeneration of the sample set caches are clearly identified on the settings screens, and there are very few. Changing per-rank options via *Organ | Load organ, adjusting rank audio output routing* also causes the sample set data cache to be regenerated for the selected sample set.

As soon as the sample set has finished loading, Hauptwerk will automatically attempt to start its audio and MIDI engines. If any errors occur relating to unsupported sample rates you should use *Functions | Deactivate* and change the VST host program's sample rate to 44100 Hz, which is the sample rate required for the St. Anne's sample set (or 48 kHz if the *StAnnesMoseley-ForLocked48kHzDrivers* organ is loaded instead of the default *StAnnesMoseley*). Different sample sets may require different sample rates; please see the documentation provided with the sample set. For V-STack, changing the sample involves locking the sample rate to the required value in the sound/audio interface driver's control panel, then re-starting V-STack. When the sample rate has been locked to the correct value, attempt to load the sample set again. For Cubase and most other VST hosts, the sample rate is simply a project setting.

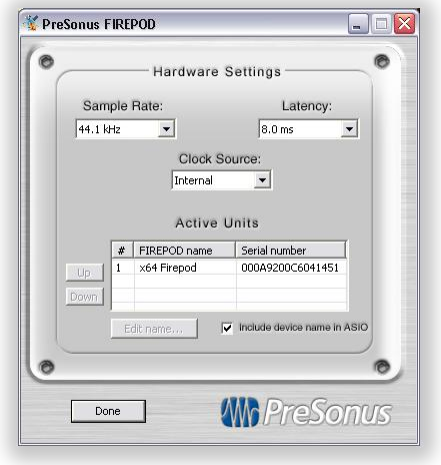
Once the audio and MIDI systems are activated, the St. Anne's organ console should appear:

Click on the 'OPEN DIAPASON LARGE 8' stop on the right-hand side of the console to engage it.

Now click on a key on the lower of the two virtual manuals (keyboards), and hold it down. You should be able to hear the corresponding pipe sounding. If not, check the audio connections, that the amplifier is turned up, and the VST host program's audio settings.

If the sound is breaking up or crackling whenever any pipe sounds, then first of all check that the audio connections and wiring are good. If so, try a larger audio buffer size setting using the VST host program's audio setting screen to open the ASIO driver's control panel. The buffer size setting determines the delay between pressing a key and hearing the sound, termed the *latency*. Buffer sizes in the region of 1024 samples usually work well, but you can certainly use smaller buffer sizes to give a faster response (lower latency) if your driver supports it, usually at the expense of a little polyphony. Most professional audio interfaces can manage a buffer size of 512 samples without a significant reduction in polyphony.

The appearance of the ASIO control depends on the audio/sound interface you are using. The following image shows the FirePod's control panel:



Before you change any settings on the ASIO control panel, you must go to *Functions | Deactivate MIDI and audio* in Hauptwerk, then *Functions | Activate MIDI and audio* to re-start Hauptwerk's audio engine with the new settings afterwards.

Note that the driver and the buffer size setting determine the latency, rather than Hauptwerk itself.

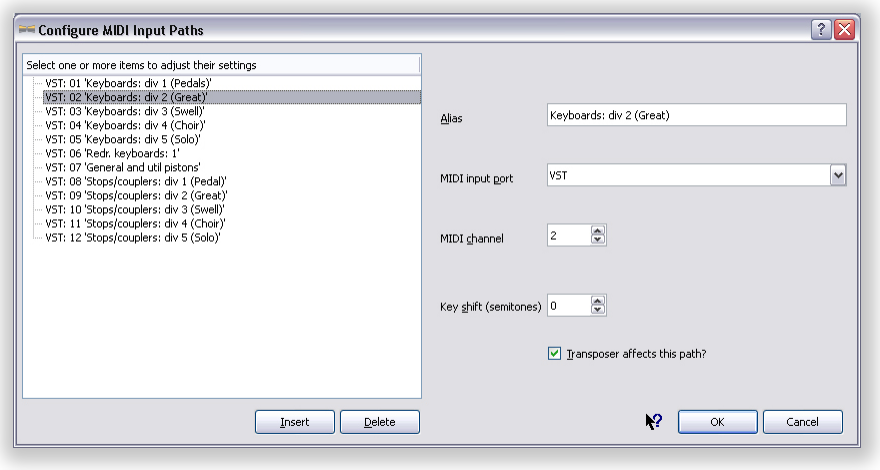
Configuring MIDI input: Sonar

The methods now required to configure MIDI input to Hauptwerk's virtual keyboards and continuous controls (swell and crescendo pedals) depend slightly on the type of VST host program you are using.

Sonar can be played 'live' from MIDI keyboards or a MIDI organ console, and configuration is similar to the stand-alone Hauptwerk configuration.

Connect the MIDI output port on your MIDI keyboard or organ console to a MIDI input port on your computer (one which was set to be active in Sonar) using a proper MIDI lead and any adapters that are necessary. Determine the MIDI channel on which the MIDI keyboard, or main manual of the organ console, is set to transmit, consulting the manual for the keyboard/organ if necessary.

From the Hauptwerk menu choose *General settings | MIDI input paths*. In the left-hand pane, click on the '... Keyboards: div 2 (Great)' entry (each entry is prefixed with 'VST' and then the MIDI channel currently selected for the path for clarity). Change the *MIDI channel* setting in the right-hand pane to match the channel on which the MIDI keyboard or main keyboard of the MIDI organ is set to transmit, as determined previously:

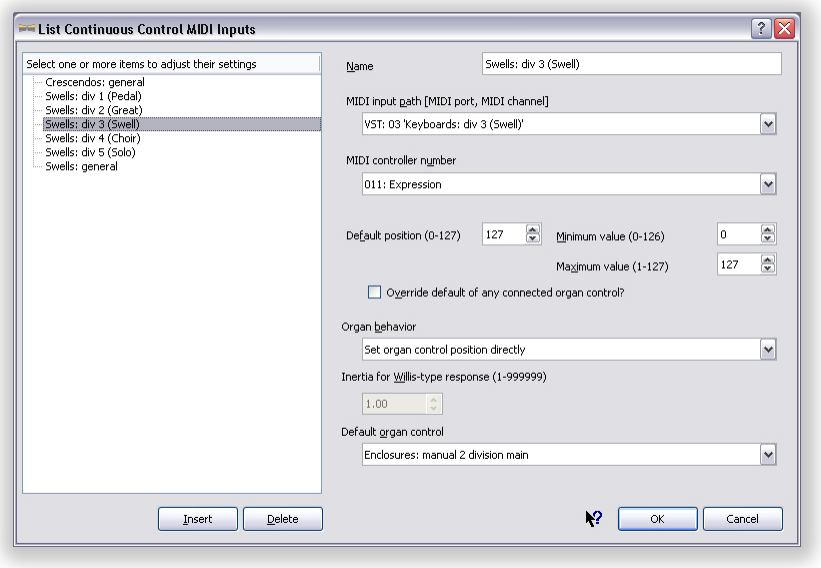


Click *OK*. If an error message appears, indicating that two MIDI input paths have the same port and channel setting, then see which other MIDI input path is shown in the message, dismiss the message, and change the MIDI input channel for that path to an unused value, then *OK* the screen again. For example, if the message states that the '... Keyboards: div 2 (Great)' and '... Keyboards: div 3 (Swell)' have matching port and channel settings, then select the '... Keyboards: div 3 (Swell)' entry in the left-hand pane, and change its channel number in the right-hand pane.

If you only have one MIDI keyboard, then the basic configuration is complete, and you are ready to use Hauptwerk.

If you have more MIDI keyboards or a MIDI pedalboard, use the *General settings | MIDI input paths* screen to configure the MIDI channels appropriately for the corresponding '... Keyboards: ...' entries listed in the left-hand pane.

If you have any MIDI continuous controller pedals, such as MIDI swell/expression pedals, with which you wish to control Hauptwerk's virtual swell and crescendo pedals, go to *General settings | Continuous control MIDI inputs* from the menu. If you have a pedal that you wish to use as a swell pedal, select the 'Swells: div 3 (Swell)' entry in the left-hand pane:



Set the MIDI controller number to match the controller sent by the pedal. The most common controller numbers are:

- 1 - Modulation wheel.
- 4 - Foot controller.
- 6 - Data entry control.
- 7 - Main volume.
- 11- Expression.

If the MIDI pedal has the same MIDI channel as the keyboard, then choose the entry for that keyboard in the *MIDI input path* list. If not, you will need to go back to the *General settings | MIDI input paths* screen, and create a new path by clicking the *Insert* button for the channel, finally returning to the *General settings | Continuous control MIDI inputs* screen to select it for the swell pedal.

If you have a MIDI pedal to use as a crescendo pedal, again using the *General settings | Continuous control MIDI inputs* screen, select the 'Crescendos: general' entry in the left-hand pane and select the MIDI input path (creating a new one, as for the swell pedal, if necessary) and controller number.

Finally, with the St. Anne's organ still active (having dismissed any settings screen that may have been open), check that each MIDI keyboard causes the corresponding virtual keys to move on the screen in Hauptwerk. Likewise, check that any MIDI continuous control pedals cause the corresponding virtual swell or crescendo pedals to move in Hauptwerk. If not, go back and check and correct the settings as necessary.

Configuring MIDI input: sequencers

The exact configuration steps required depend significantly on the sequencer program. In general, you need to select Hauptwerk as a virtual instrument, then route the output from the tracks to that virtual instrument, with the MIDI channel determining which of Hauptwerk's virtual keyboards should be played. With the initial default configuration (assuming you haven't re-assigned any MIDI channels with the *MIDI input paths* screen in Hauptwerk), the MIDI channels are:

- Keyboards: div 1 (Pedals) - 1.
- Keyboards: div 2 (Great) - 2.
- Keyboards: div 3 (Swell) - 3.
- Keyboards: div 4 (Choir) - 4.
- Keyboards: div 5 (Solo) - 5.

Hauptwerk's swell and crescendo pedals can be controlled by inserting MIDI continuous controller messages in a track in the MIDI sequencer, with the track's output routed to the Hauptwerk virtual instrument, and choosing the MIDI channel and continuous controller to match those of the MIDI input path and continuous controller selected for Hauptwerk's *General settings | Continuous control MIDI inputs* screen. With the initial default configuration (assuming you haven't re-assigned any MIDI channels with the *MIDI input paths* screen, or continuous controller numbers with the *Continuous control MIDI inputs*), the channels and controller numbers for Hauptwerk's swell and crescendo pedals are as follows:

- Crescendos: general - channel 7, controller number 2 (breath control).
- Swells: div 1 (Pedal) - channel 1, controller number 1 (modulation wheel).
- Swells: div 2 (Great) - channel 2, controller number 1 (modulation wheel).
- Swells: div 3 (Swell) - channel 3, controller number 1 (modulation wheel).
- Swells: div 4 (Choir) - channel 4, controller number 1 (modulation wheel).
- Swells: div 5 (Solo) - channel 5, controller number 1 (modulation wheel).
- Swells: general - channel 7, controller number 1 (modulation wheel).

Finally ...

For further information, including the MIDI messages you should insert into sequencer tracks to control virtual draw-knobs, pistons and other virtual organ controls, please see the using Hauptwerk: MIDI sequencing section. For more detailed information on how to use and configure Hauptwerk's MIDI settings in general, please also consult the MIDI input section.

Because VST plug-ins cannot usually display options screens when they launch, if you don't have a licensed edition of Hauptwerk and want to use an edition other than the Advanced Edition evaluation (the default) for the VSTi version of Hauptwerk: open Hauptwerk (by default it will start in Advanced Edition evaluation mode if no Hauptwerk USB key is found), go to the *General settings | General options* screen and change the *Default unlicensed edition* preference there for which edition to use/evaluate, then unload and re-load the plug-in to re-start Hauptwerk. You will then be able to use/evaluate the edition you selected.

Finally, please now make a backup of your Hauptwerk settings and data following the step-by-step 'How to make a backup' instructions in the backups section of the guide. Doing so should allow you to get your current settings back in case your computer ever needs to be re-installed in the future.

Section IV: Background

A brief tour of a pipe organ

If you are unfamiliar with pipe organs and their terminology this section should give you a background sufficient to find your way around Hauptwerk.

A pipe organ has one or more keyboards, termed *manuals*, and usually a *pedalboard*, which is effectively another keyboard played by the feet. The *console* is the part of the organ with which the organist interacts, containing the keyboards and controls used to play the organ.

Different tones are produced by engaging sets of pipes, each with a particular tonal quality. Such a set of pipes is termed a *rank*, and usually has one pipe for each key on the keyboard or pedalboard. The rank is engaged and disengaged with a switch on the console called a *stop*. The stop switches on the console are usually physically either *draw-knobs* (push-off, pull-on) or *tabs*.

Each rank is usually attached to only one manual or the pedals. A manual (or the pedals) together with the set of stops (and hence ranks and pipes) that are attached to it is termed a *division*. Each division has a name and a particular overall tonal character. Of course, organs from different countries have different names for the divisions and traditions have led to differences in their tonal structure.

On an English pipe organ, there are usually between two and four manuals and a pedalboard:

- The *Pedal* division is used to play the bass parts and has the deepest sounds.
- The *Great* (bottom manual or second manual from the bottom) division has the main and loudest organ sounds (the *diapason chorus* or *principal chorus*).
- The *Swell* (second or third manual from the bottom) division has more orchestral and imitative sounds, such as oboes, clarinets and varieties of string-like sounds. Its tone is usually controlled by a *swell pedal*, which operates shutters on a box that encloses its pipes, allowing the sound volume and brightness to be increased or decreased.
- The fourth division usually found is the *Choir*, with its manual positioned below the Great manual. It contains softer, plainer stops for accompanying singers.
- If there is a fifth division, it is usually the *Solo*, positioned as the top manual and containing louder, prominent, solo stops.

The Choir and Solo divisions are sometimes enclosed in separate swell boxes operated by independent swell pedals.

The stops are designed to complement each other both in terms of timbre, volume, and the pitch at which they sound. The pitch of many stops is used to reinforce the harmonic content of other stops, when used in combination with them. The numbers on stops indicate their pitch in feet. The number indicates the length of the lowest C pipe in the stop, hence the lowest C pipe on an *Open Diapason 8* stop is 8 feet in length. 8' stops are the 'normal' (*fundamental*) pitch of the manuals. A 4' stop will sound exactly one octave higher than an 8' stop, hence engaging a 4' stop reinforces the second (octave) harmonic of the 8' tone. A 2' stop will reinforce the fourth harmonic, two octaves above the pitch of the 8' stop. The lowest stops usually found are 32', in the pedal divisions of very large pipe organs. Sounds below a 32' C are not audible to the human ear. The highest stops are commonly found are $1\,^{1}/_{3}$', again bordering on the human hearing range at the top of the manual.

Some stops have fractional lengths, such as the *Quint* $2\,^{2}/_{3}$. These are termed *mutations* and enforce harmonics that are not octaves of the 8' fundamental tone. For example, playing a C note on a $2\,^{2}/_{3}$' stop will sound a note approximately equal in pitch to playing a G note an octave and a half above the C on an 8' stop, reinforcing the third harmonic. A $1\,^{3}/_{5}$' stop will play two octaves and a major third above an 8' stop. These stops would not normally be played without their non-fractional counterparts, since they would effectively transpose the music played.

Most organs have one or more *mixture* stops. These have more than one pipe per key (and thus several ranks), and the number of pipes per key is indicated in the stop name; a *Mixture IV* has four pipes per key, for example. The intervals that separate the pipes comprising the mixture (the *mixture composition*) vary, and they often vary across the compass of the manual. Most frequently, they contain a 2' stop and various mutations (of the fundamental 8' tone) built around it. They are used to add a shrill sheen to the sound, and again are almost never used as solo stops.

The name of a stop (rank) also indicates its tonal qualities. There are four main tonal groups:

- *Diapasons* or *Principals* are of pure 'organ tone' and are rich in harmonics, with a full-bodied sound. These form the main *diapason chorus* on the Great, the backbone of the organ. Secondary, softer diapason choruses are often found on other manuals. They appear under various names - *Diapason*, *Principal*, *Octave*, *Fifteenth*, *Prestant*, *Montre*, and are usually also used for the mutations and mixtures.
- *Flutes* have less harmonic development, and are of a softer, purer sound. Some examples are the *Gedackt*, *Clear Flute*, *Harmonic Flute*, *Rohrflute*, *Hohl Flute* and *Bourdon*.
- *Reeds* produce sound in a different way to other pipes, in that a metal *reed* vibrates mechanically against a *resonator* tube. They are very rich in harmonic content and may be very loud and brilliant. Common examples are the *Trumpet*, *Clarion*, *Trombone*, *Clarinet*, *Oboe*, *Crumhorn* and *Contra Fagotto*. They may be used as solo stops or to add vibrance and presence to a chorus of other stops.
- *Strings* are (usually) strictly a subclass of the diapasons, but with a much narrower scale of pipe. They are harmonically rich and designed for their string-like qualities. Common examples are the *Viola*, *Gamba*, *Salicional*, *Viola di Gamba*, *Salicet*, *Geigen Principal* and *Violin Principal*. They are usually warm and soft in tone.

Some pipes are classified as *imitative*, in that they are designed to sound as close as possible to their orchestral namesakes. The *Clarinet* is one such stop.

Modern keyboards and synthesizers are almost always tuned to *equal temperament*, meaning that the musical interval between any two consecutive notes (a semitone) is constant across the whole keyboard. Although this is not musically 'perfect' (if you play a C and an E together, for example, you can hear a phasing because the harmonics are not perfectly tuned), it means that music can be transposed and progress through different keys and the tuning will sound exactly the same. It is a compromise. Alternative *temperaments* (tunings) are quite often found in organs, where the different effect of each key may be used to advantage, particularly with historical music.

A very few organ stops are deliberately tuned sharp or flat, relative to the other stops on the organ. The *Celeste* is the most common example, which is designed to produce a chorus effect when played with specific other stops, such as a *Viola di Gamba*.

The Encyclopedia of Organ Stops website (see the links page on the Hauptwerk website) is a useful reference for stop classification.

Couplers are mechanical, pneumatic or electrical devices that link manuals or divisions together. Their controls usually have the same appearance as stops, in that they are usually controlled by draw-knobs or tabs. If the *Swell To Great* coupler is engaged, then playing a note on the Great manual will play the same note on the Swell manual, enabling their sounds to be combined and borrowed from other divisions. Note the order in which the manuals are listed in the name: the division appearing first in the name plays automatically when the second is played by the organist.

Couplers may link keyboard keys physically, so that pressing a key on one manual actually causes the corresponding key on the coupled keyboard to move. However, more usually, a coupler affects only the *key action*, being the way in which the keyboard is connected to the pipes, and so no additional keys are seen to move when the coupler is engaged.

Couplers may couple at *non-unison* pitch. For example, the *Swell To Great Octave* coupler will play a note on the Swell that is one octave higher than any note pressed on the Great. Non-unison couplers may also act upon the same division as the key pressed. For example, the *Swell Octave* coupler will play a note one octave higher on the Swell for each note on the Swell that is played by the organist. In this case, the couplers are used to increase the strength of the second and upper harmonics.

The *Unison Off* coupler prevents keys played directly from sounding at all, but allows coupled keys to sound. For example if you play a middle C on the Swell with the Swell Octave and Swell Unison Off couplers engaged, the middle C will not sound, but the C above it will.

Stops do not always have pipes for all notes on the keyboard for their division, although most do. If a stop only has pipes from the second C from the bottom of a 61-note keyboard (for reasons of economy when the organ was built), it is usually shown with a *TC* or *Tenor C* legend in the specification. Occasionally, the pipes for a division extend beyond the range accessible by the keys, so that non-unison couplers continue smoothly into the top or bottom octaves.

Sometimes stops or even parts of stops are *borrowed* from ranks from other divisions. A pedal *Trumpet 8 (Gt)* stop indicates that the pipes from the Great Trumpet 8 rank actually sound when the stop is engaged, even though the stop belongs to another division. This is a fairly common economy on the part of organ builders, and is usually indicated by the 'real' division appearing in brackets.

Organs which have a small number of pipe ranks, from which many stops are *derived* (borrowed) are termed *unified* or *unit* organs, the method being *unification*. In particular, *theatre/cinema organs* are constructed on this principle, with a small number of ranks from which a great number of stops are derived at many pitches, and it is a key aspect of their sound.

Couplers occasionally act upon only some stops in a division. For example the *Swell Reeds To Great* coupler only links the reed stops from the Swell to the Great.

Bass couplers are special in that they only couple the lowest note played. They are fairly common on smaller instruments, where the organist may not be competent in the use of the pedals, and allow the Pedal division to be played 'automatically' by the lowest note played on a manual. For Hauptwerk users without a MIDI pedalboard they are an especially useful inclusion. *Melody/Melodic couplers* are similar, but couple only the highest note played, thus emphasizing a solo melodic line.

A *ventil* is another (fairly uncommon) playing aid, which simply 'turns off' a set of ranks, usually by shutting a valve which prevents any air reaching their pipes.

A *tremulant* is a mechanical contrivance by which the air pressure supplied to the pipes is varied periodically, giving a 'tremble' to the sound. Its effect is to vary the pitch, amplitude and harmonic content of the sound of each pipe in complex ways, and with complex modulating waveforms. It is usually accomplished with a pneumatic motor venting air from the pipes' supply. It is another key aspect of the sound of a theatre/cinema organ. Tremulants are usually turned on and off by draw-knobs or tabs on the console.

Buttons on an organ are usually termed *pistons* due to the way in which they worked historically.

A *combination action* is a mechanism by which combinations of stops, couplers, tremulants and other controls can be memorized and recalled with a single piston button. These pistons are usually located below the manual and above the pedals and memorize controls for the corresponding division (*divisional combinations*), and sometimes also store combinations for all of the settings on the organ, regardless of division (*general combinations*).

A combination action may be *fixed* or *programmable/adjustable*. In Hauptwerk, all combinations can be programmed, and any current setting can usually be captured to any combination piston appropriate to the division. As do some pipe organs, Hauptwerk also has a *registration sequencer* comprising a series of programmable *combination frames*, which are general combinations that form a sequence, allowing all of the stop movements for a recital to be recorded and cycled through by pressing a single piston.

Note that some combination actions cause the associated draw-knobs or tabs to move physically when they are triggered, whereas others invisibly add to or replace the registration shown on the console, and have a 'state' (on or off), and may be

grouped so that only one can be selected at any one time. The former system is more common in English organs, the latter in European organs.

The *FF*, *Tutti*, or *Full Organ* switch (piston, draw-knob or tab) is an example of stateful combination, which turns on the main chorus stops and couplers to give a loud, full and majestic sound conveniently, without moving the stop and coupler switches physically, and usually adding to their registration.

Some organs have *combination couplers* that couple divisional combination buttons. For example, if the *Great Pistons To Pedal* coupler is engaged, pressing a Pedal combination piston also activates the corresponding Great piston.

Sometimes *reversible pistons* are available to provide convenient short-cuts for often-used couplers (or other controls). Each time they are pressed, they toggle the state of their associated coupler. The *Swell To Great* coupler often has such a reversible piston.

A *crescendo* is another playing aid, sometimes found on larger instruments. It is operated by an expression pedal (like a swell pedal), and engages and disengages combinations of stops as it is moved. It is usually programmable, and configured so that progressively louder stops are engaged as it is moved forward, and disengaged as it is moved backwards, thus giving a convenient crescendo or diminuendo while keeping the hands free.

Theatre organs often have *second touch* on their manuals, whereby pressing a key down further than normal causes additional (usually solo) stops to sound. The stops triggered in this way can usually be selected from separate stop switches on the console.

Some organs (especially theatre organs) also have *percussion stops*, such as *carillons* (bells), acoustic pianos, glockenspiels and so forth, struck by hammers when the corresponding keys are pressed. Sometimes non-tuned percussion stops are triggered from knee levers, or whenever any key is pressed regardless of its pitch, or by other devices. Sometimes also such percussion are *reiterated*; struck repeatedly while a key or piston is held down. A theatre organ drum roll is an example.

Theatre organs also have *effects traps*, which are usually pneumatic contraptions producing special effects sounds, such as sirens, surf and bird song, turned on and off from switches on the console, and originally used for the accompaniment of silent films.

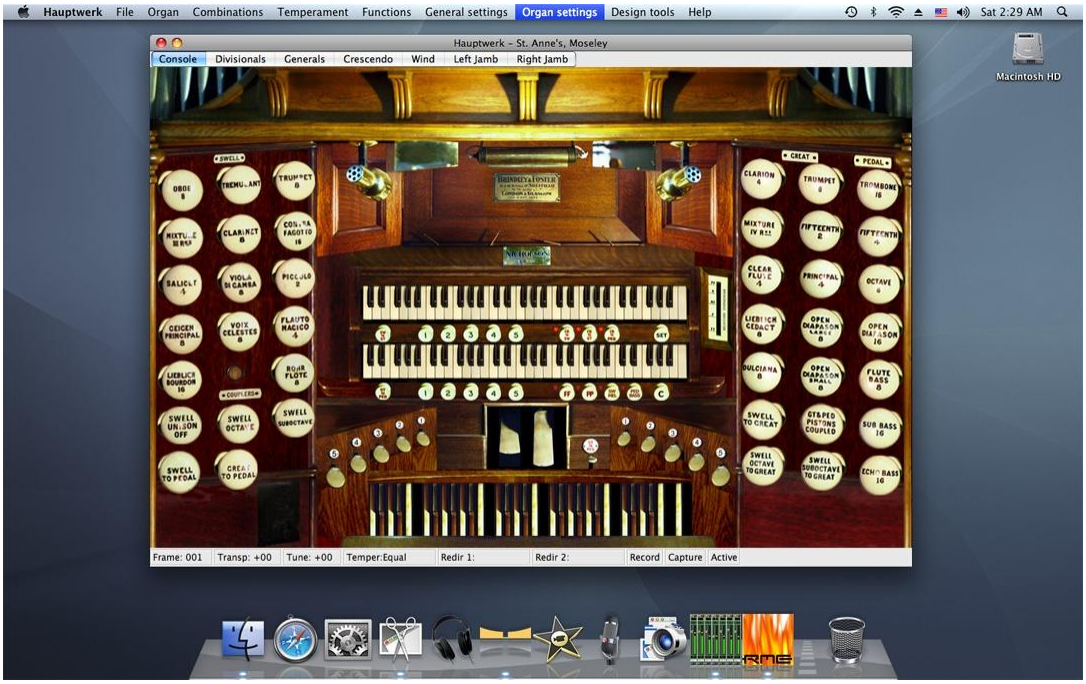
All of the above mechanisms can be modeled in Hauptwerk.

There are many books available that describe the anatomy of pipe organs in great depth and some useful Internet sites with further information.

Section V: Using Hauptwerk

The virtual console

If you haven't already done so, follow the relevant 'quick start' section in this guide. If it isn't loaded already, use *Organ | Load organ* on the Hauptwerk menu to load the St. Anne's, Moseley organ sample set. It should look approximately as follows:



The left and right-hand panels on the screen are the *stop jambs* and contain the stops, couplers and tremulant virtual draw-knobs. As you have already seen, clicking on a virtual draw-knob toggles it between the off and on states. A draw-knob is *on* when it is pulled out. In fact, all *virtual switches* can be controlled by the mouse, provided that the creator of the sample set has allowed it. A switch is either *latching* or *momentary*. Latching switches (such as draw-knobs) change state when clicked, while momentary switches (such as keys) turn on when you press the mouse button and turn off again when you release it.

Although you would not normally operate the organ by clicking on virtual controls with the mouse, it is a quick and useful way to explore a virtual instrument initially.

The left-hand jamb has the stops and couplers for the Swell division, which is played from the upper of the two virtual manuals. The far-right column of draw-knobs has the stops for the Pedal division, which is played from the virtual pedal keyboard in the center at the bottom of the screen. The next two columns on the right-hand jamb are the Great stops and the Great and Pedal couplers. The Great division is played from the lower of the two virtual manuals.

You can click on any of the three virtual keyboards to play their keys. You must have at least one stop engaged for the relevant division in order to hear any pipes when you play a key. For example, turn on the Oboe 8 stop on the left-hand jamb, and then click on a key on the upper virtual manual, and you should hear the Oboe pipes sound.

Draw (engage) a stop on the Swell, such as the Oboe 8, but with none engaged on the Great. Click on a key on the Great manual. You should not hear the sound of any pipes. Now draw the Swell To Great coupler and click on a Great key again.

You should now hear the corresponding Oboe pipe sound. Note, however, that the virtual keys on the Swell manual do not move because the coupling happens internally, within the key action, rather than between the manuals directly.

With the Oboe 8 still engaged, turn on the *Tremulant* at the top of the left-hand jamb. Click on a key somewhere in the middle of the Swell manual. You should hear that a gentle undulation is imparted to the sound. The effect varies for each rank, and across the compass of the manual. The Tremulant only affects the Swell ranks.

Above the virtual pedalboard are two large pedals. The left-hand one is the *swell pedal*. Click on the virtual swell pedal near the bottom of its image and you should see it move. The virtual swell box is now closed. With a stop engaged on the Swell (such as the Oboe 8), play a key on the virtual Swell manual and note how it sounds. Now click on the swell pedal near the top of its image and you should see it move again. The swell box is now open. Play a key on the Swell manual again, and it should sound different. Clicking in the middle of the swell pedal image will cause the swell box to be open only half way.

The second, right-hand, large pedal is the crescendo pedal. It is moved in the same way as the swell pedal, by clicking at different vertical positions on its image. Try different positions while playing keys on the Great manual each time. You should hear more pipes sound according to how far 'down' it is (how near to the top you have clicked). You will not see the virtual draw-knobs move, but note that the Brincradus indicator, immediately to the right of the two manuals, also moves to show its position.

These two pedals and the Brincradus indicator are examples of *virtual continuous controls*, in that they can be in any one of a continuous range of positions, rather than just on or off as with virtual switches. All virtual continuous controls can be operated in the same way by clicking at different positions within their images, provided that the sample set allows it. Note that the Brincradus indicator is an example of a continuous control for which mouse control is *not* allowed, since it is not itself a user control, but merely an indicator of a state within the organ. The wind indicators (covered later) are further examples. Most continuous controls are set by the vertical click position but others are set by the horizontal click position (none on St. Anne's).

Switches and continuous controls are the two possible types of *virtual controls* available in Hauptwerk.

Underneath the Swell (upper) manual and to the right are three latching pistons named *Cr To Ped*, *Cr To Gt* and *Cr to Sw*, each with a small red indicator lamp to show whether they are on or off. The indicator lamps are examples of switches which cannot be controlled by the mouse because they too are indicators and not user controls directly. These three pistons determine whether the crescendo pedal affects the Pedal, Great and Swell divisions respectively.

The *FF* piston underneath the Great (lower) manual is also latching with an indicator lamp. When engaged the *full organ* registration (tutti) is engaged, *adding* to whatever registration is shown on the draw-knobs. The *PP* piston is another playing aid, which entirely bypasses the draw-knob registration, *replacing* it with a soft registration.

On the far right, underneath the Great manual, the piston labeled *C* is the *general cancel*. Clicking on it causes all draw-knobs to be turned off, but does not affect the crescendo, FF or PP pistons.

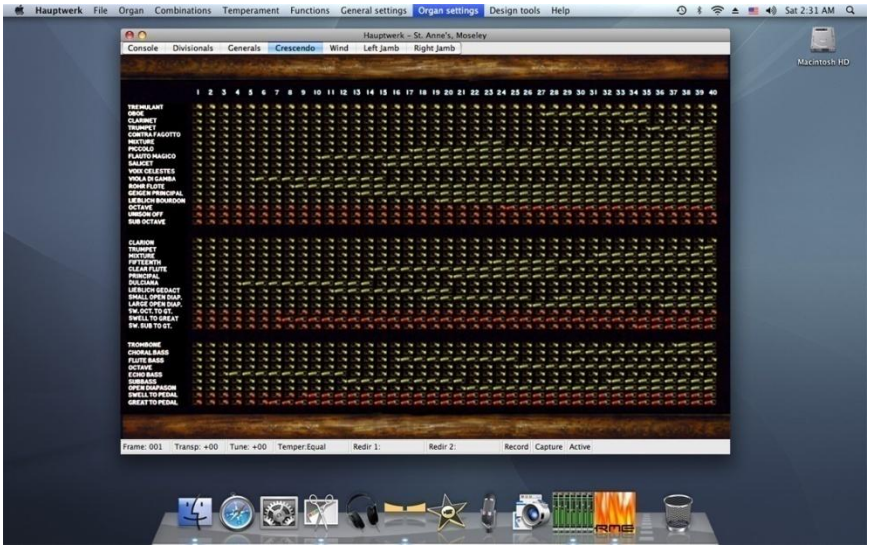
The console display has multiple tabs. If you have the Advanced Edition of Hauptwerk you can open up to four tabs at once in separate windows using the *Organ | Show another console window* menu function:

This is most useful if your computer has two or more touch-screen monitors attached to it. For example, you could display one window (display tab) on a monitor to the left of your MIDI keyboard(s) and another to the right to give a traditional organ console layout with some stops on either side of your MIDI keyboard(s) when using sample sets that have their virtual console tabs laid out in that way.

Click on the *Generals* tab, and you should see the following screen:

You can use this screen to adjust the registrations set by the FF and PP pistons. Click on a switch to toggle its state, as normal for virtual switches. The switches on the screen are on when they are moved to the left.

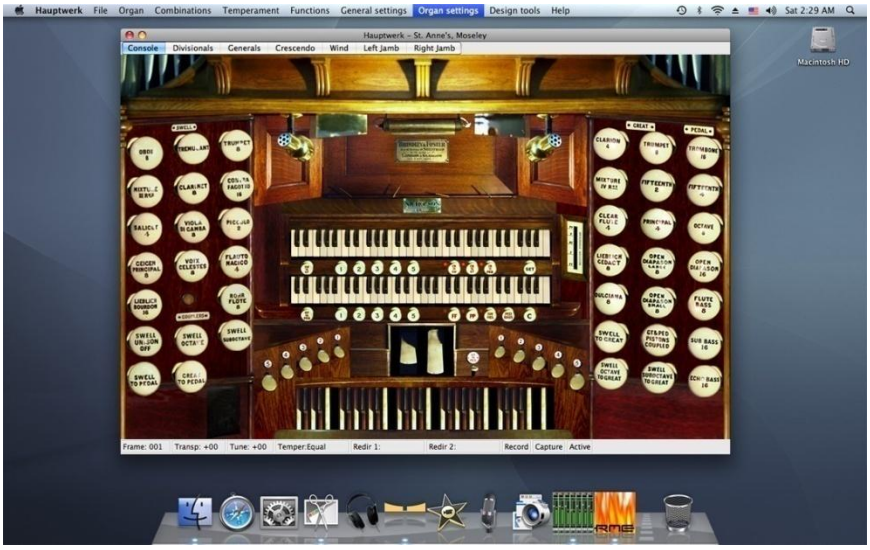
Click on the Crescendo tab:



The switches control the registration at each of the forty possible crescendo pedal positions. When the pedal is fully up (off; clicked at the bottom of its image), the crescendo action will cause no additional stops to be engaged. When it is moved very slightly down (clicked slightly higher on the image), the registration shown in the column labeled *1* will be added to whatever registration is shown on the draw-knobs. Slightly more, and it will be that from column *2*, and so forth until it is fully down, when column *40* will determine the registration added. As the pedal is moved backwards, the sequence is reversed.

As with the *Generals* tab, a switch is on when it is pointing to the left.

Go back on the main *Console* tab:



Immediately underneath the manuals and to the far left are reversible pistons for the Sw To Gt and Gt To Ped couplers. If you click on those pistons you will see the corresponding virtual draw-knobs move. Immediately to the right of the crescendo pedal is another reversible piston for the Gt To Ped coupler.

To the right of the PP piston are the *Sw Mel* and *Ped Bass* couplers. Both are latching switches with indicator lamps. The former causes only the highest key played on the Great manual to sound on the Swell division, while the latter causes the lowest key played on the Great manual to be duplicated on the Pedal division. The Ped Bass coupler may be particularly useful if you do not have a MIDI pedalboard.

The pistons numbered 1 to 5 underneath the Great manual are *divisional pistons*. If you click on them you will see the draw-knobs move for the Great stops and couplers as each of the stored registrations is recalled. The pistons labeled 1 to 5 underneath the Swell manual do likewise for the Swell stops, couplers and tremulant. For ergonomic convenience they are also duplicated by the foot pistons labeled 1 to 5 immediately above the pedalboard and on the left-hand side.

The pistons labeled 1 to 5 above and to the right of the pedalboard recall the Pedal divisional combinations. If the *Gt & Ped Pistons Coupled* draw-knob is drawn (near the bottom of the right-hand jamb), pressing a Pedal combination piston also causes the corresponding Great combination to be recalled. Likewise, pressing a Great combination piston causes the corresponding Pedal combination to be recalled.

Click on the *Divisionals* tab:

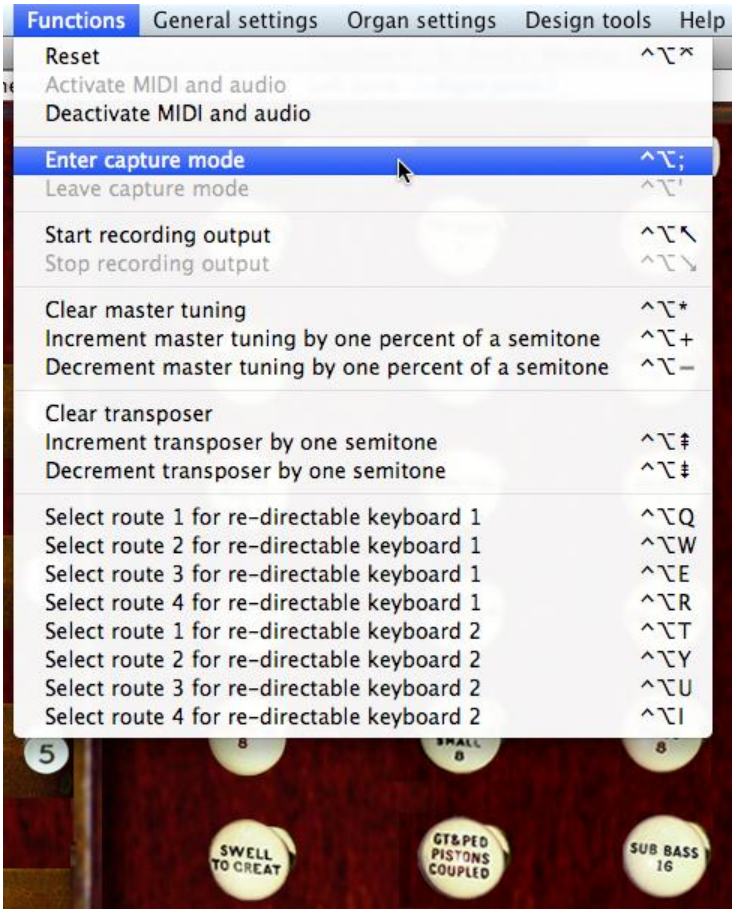
Here you can adjust the registrations recalled by each of the five pistons for each division.

Go back on the main *Console* tab again:

Underneath the Swell manual and to the far right is a piston marked *SET*. It is the *combination setter* or *combination capture* piston. It is a latching piston, but it does not have an indicator lamp. If you click on it several times, you will see that it moves in and out, and stays in that position. When it is in the 'in' position (on), choose a registration on the Swell using the virtual draw-knobs. Then click Swell divisional combination piston 1. Instead of recalling the combination stored for the piston, your current registration will have been saved to the piston. Turn off the setter piston, and click on Swell pistons 2 and 1 to verify that your combination is now recalled by piston 1. You will also be able to see your updated combination on the *Divisionals* screen tab.

Note also that the word *Capture* lights up in the status bar at the bottom-right of the Hauptwerk window when the setter piston is on:

Combination capture is a special mode in Hauptwerk, which can be controlled by the *Functions* | *Enter capture mode* and *Functions* | *Leave capture mode* menu items as well as by the setter piston:



The menu items and the setter piston perform identical functions. The menus are covered in depth in later sections of this guide.

For now, note that combinations can be saved to and loaded from *combination files*, so that you could have different sets of combinations stored for different pieces in a recital, for example. The St. Anne's divisional and general combination settings are saved in such files, along with the crescendo settings and the registration sequencer frames (covered in a later section).

The states of virtual controls can be remembered between unloading and loading an organ, defined by the creator of the sample set. However, on the St. Anne's organ all controls (draw-knobs, expression pedals, etc.) always return to their default states to avoid any confusion. The states of the switches on the three combination programmer boards are not remembered between loads because they are instead saved into combination files, which provides greater flexibility.

The final screen tab is the *Wind* tab:

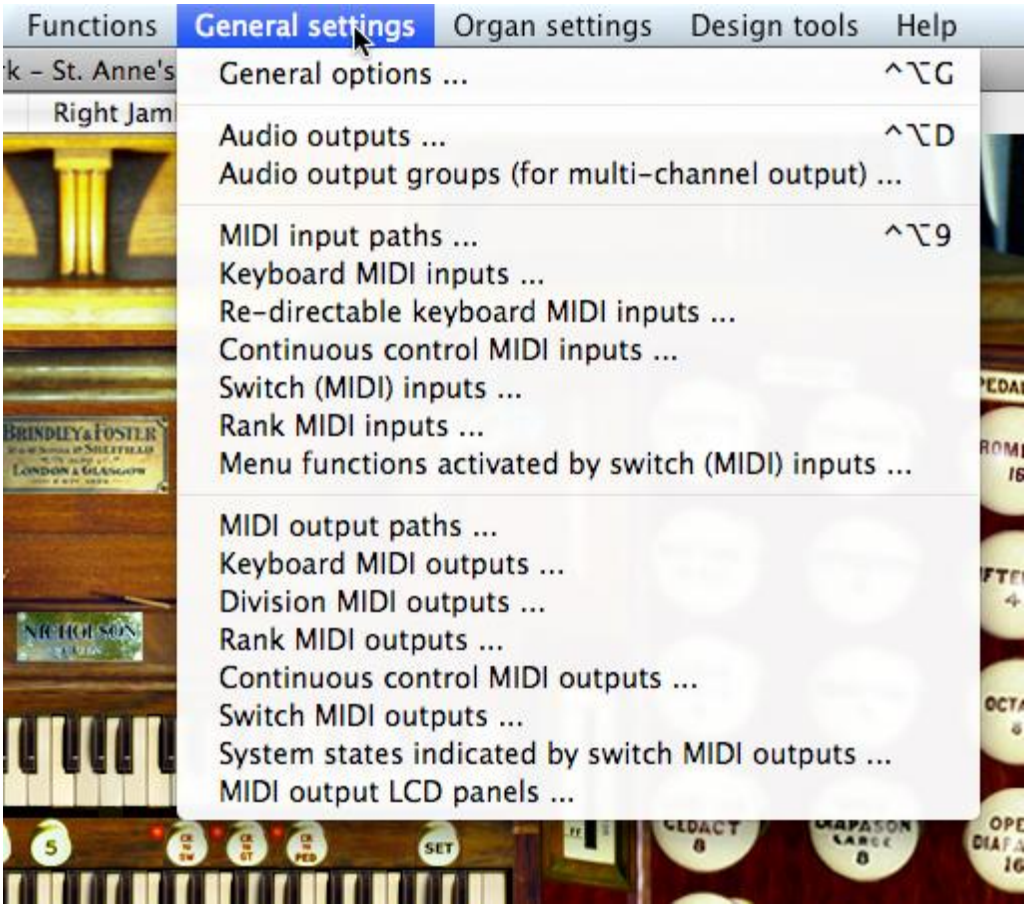
There are no controls on this tab that you can interact with directly. The indicators with numbered scales show the modeled air pressures in water column inches at various points within the virtual wind supply system. The indicators without numbered scales show the extensions of modeled regulator bellows for the system. Hauptwerk's complex wind supply physical model uses fluid dynamics principles and equations to model the movements of air through the air supply system, affecting the sound of each pipe individually as it fluctuates. Hence each pipe can interact subtly and realistically with every other pipe.

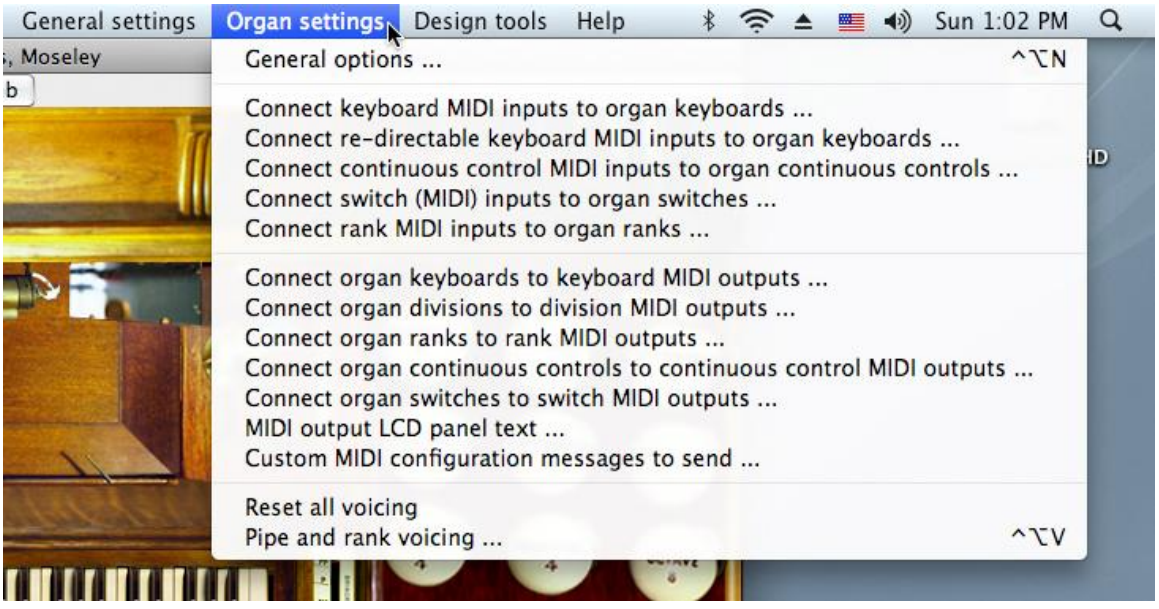
If you engage the FF piston on St. Anne's, then play and release a chord on the Great manual from a MIDI keyboard while looking at the *Wind* tab, you will see the needles move as the wind supply system adapts to the changes in demand and then stabilizes again.

(Please note: the wind supply model is only available in the Advanced Edition of Hauptwerk and is not currently available to customers in the U.S.A.)

The settings screens

Almost all of Hauptwerk's settings can be found under the General settings and Organ settings menus:





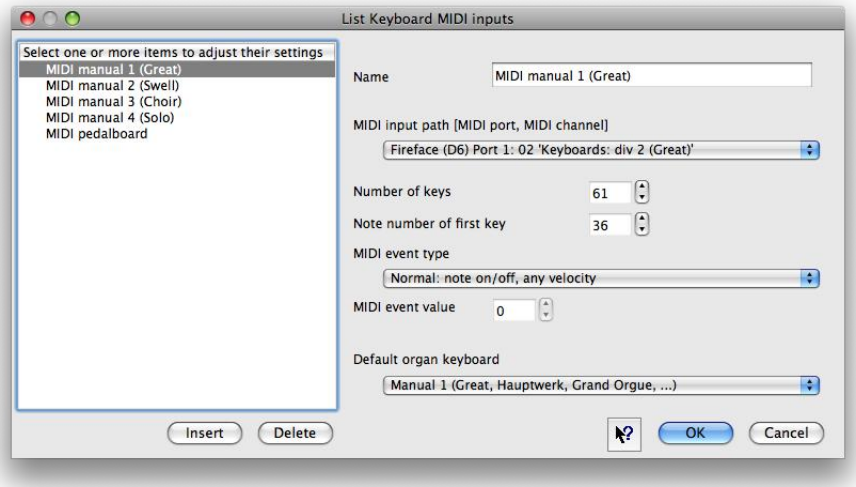
Important: It is essential to understand the distinction between the *General settings* and the *Organ settings* menus: the screens and their settings found under the *General settings* menu are mainly used to define your MIDI and audio hardware and apply to all sample sets. For example you would use the *General settings | Keyboard MIDI inputs* screen to list the MIDI keyboards you have attached to the computer. The default settings are just defaults; update or rename them to reflect your own hardware (or software) with which Hauptwerk will be used. The *Organ settings* menu instead stores settings that are specific to whichever sample set is currently loaded. Changing a setting on one of its screens only affects that sample set. The *Organ settings* menu is mainly used to map the virtual organ's controls to your hardware. For example, the *Organ settings | Connect keyboard MIDI inputs to organ keyboards* screen allows you to select which of your MIDI keyboards (that you defined on the *General settings | Keyboard MIDI inputs* screen) you want to map/connect to which of the virtual organ keyboards provided by the sample set. **Thus configuring Hauptwerk is a two-stage process: first list/configure your MIDI hardware via the *General settings* menu, then load each sample set and use the screens on the *Organ settings* menu to map your hardware to the corresponding virtual organ objects.**

If a sample set is loaded, or its MIDI system is activated, whenever you open a screen from either of these two menus Hauptwerk's audio and MIDI systems will automatically deactivate and re-activate when you close the screen. The *Organ settings* menu is only available when a sample set is loaded.

A very small number of settings (which affect the way that Hauptwerk stores samples in memory) require any currently-loaded sample set to be re-loaded into memory. Hauptwerk will automatically detect and act upon setting changes that require the sample to re-load. However, the vast majority of settings take effect almost instantaneously. Settings which can cause the sample set to re-load are clearly identified on the screens and in subsequent sections.

The screens

All of the settings screens have the same basic layout and are navigated in the same way. As an example, select *General settings | Keyboard MIDI inputs* from the menu:



Apart from the *General settings | General options* and *Organ settings | General options* screens, all of the screens allow multiple *objects* to be browsed. An *object* is an instance of the type of item whose properties the screen specifies. For example, each object on the *General settings | Keyboard MIDI inputs* screen is a logical representation of one of your MIDI keyboards, and describes its properties so that Hauptwerk knows how to communicate with it.

The left-hand pane is a browse list of the objects currently available. Many screens allow you to create new objects and delete existing ones using the *Insert* and *Delete* buttons underneath the browse list.

Most screens require you to give each new object a unique name, so that it can be identified uniquely in the browse list, and so that you can refer to it from other screens. You should always use meaningful names.

However, bear in mind that the names have no other functional effect. For example, although the object shown above is named 'MIDI manual 1 (Great)', there is no reason that you have to use that entry for, or only for, MIDI from the Great keys; it is simply a user-friendly name for the entry, which you are completely free to change.

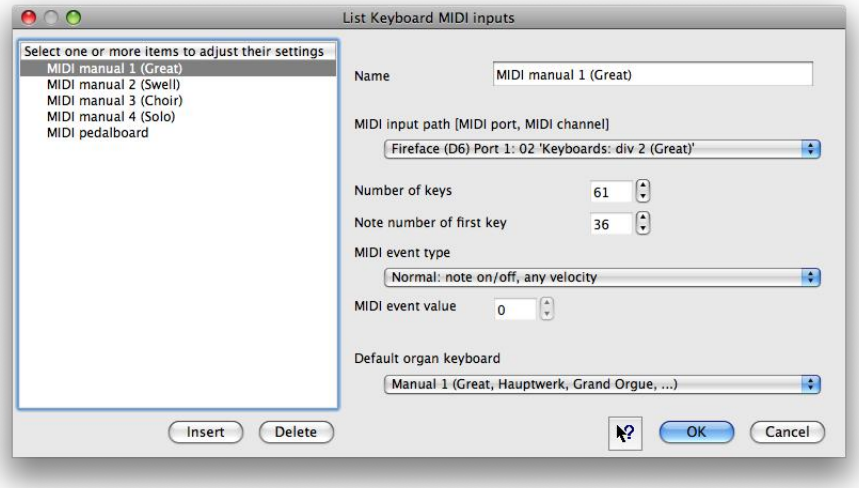
The right-hand pane of each settings screen specifies the properties of the object currently selected in the object browse list. For example, in the screenshot of the *List Keyboard MIDI Inputs* screen above, the 'MIDI manual 1 (Great)' object is selected in the left-hand pane, and the properties of that object are shown on the right, where you may view or adjust them.

Some screens have multiple tabs for their right-hand panes.

Whenever you move to a different object in the browse list, or click on OK, Hauptwerk will check that the settings are valid for the object that you are leaving, and give an error, while preventing you moving to the new object if not. For example, *Name* settings are always mandatory (must be entered), so you would receive an error if you inserted a new object and did not give it a name before attempting to select a different object.

When you click *OK* on a screen, the uniqueness of object properties is validated where necessary. For example, the *Name* settings must always be unique, so an error would be given if you had two objects with the same name, and you would not be able to OK the screen until you had changed one of them. On some screens several settings must be unique as a combination. For example, on the *Configure MIDI Input Paths* screen pictured above, no two objects can have the same *MIDI input port* and *MIDI channel* as a combination.

Some screens have settings which refer to objects from other screens. For example, the *MIDI Input path* setting on the *General settings | Keyboard MIDI inputs* screen refers to the *General settings | MIDI input paths* screen:



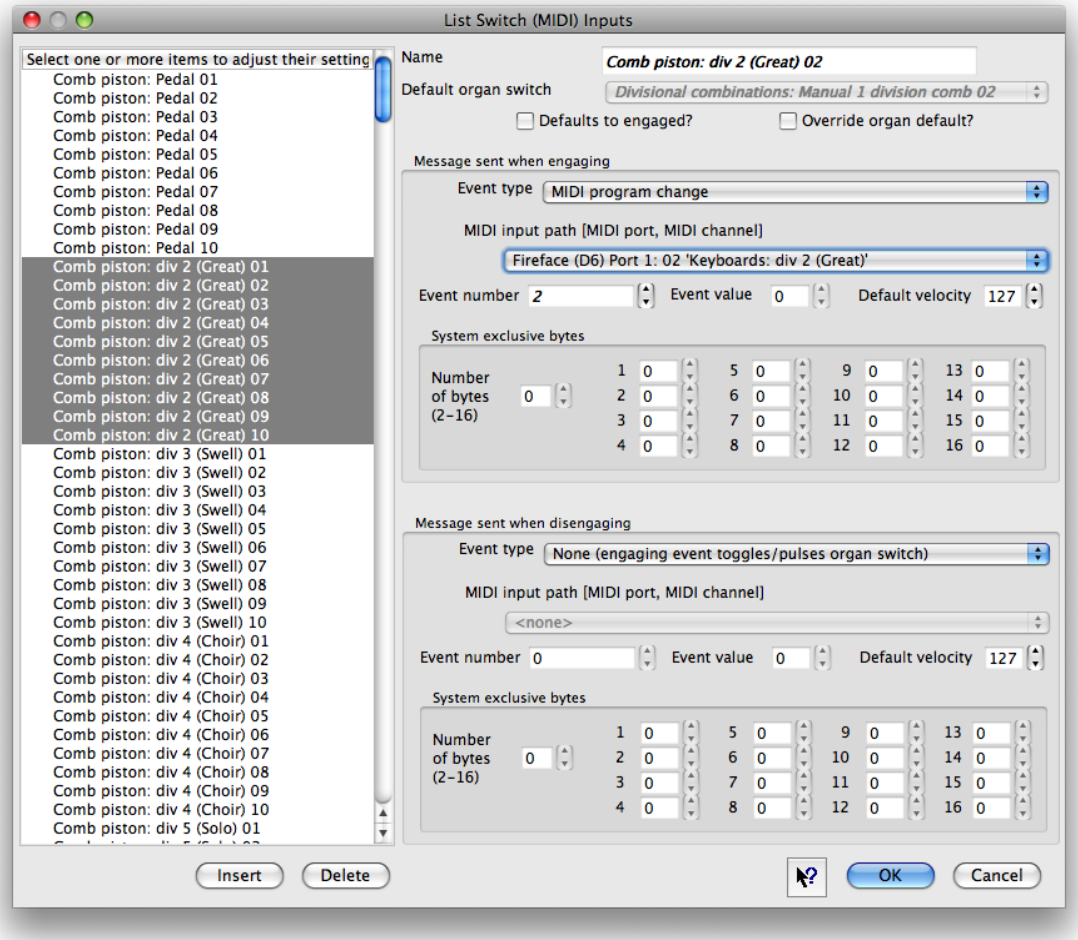
If you attempt to delete an object which is referenced from another screen, Hauptwerk will give an error and prevent the object being deleted. If you wish to delete the referenced object (MIDI input path in this case), you must first delete the referring object (keyboard MIDI input), or change the value of its referring setting (select a different MIDI input path for that keyboard MIDI input).

Note that some settings are enabled and disabled (grayed out) depending on your selections for other settings, or are always disabled if they are for information only. Note also that you can press the *INSERT* or *DELETE/BACKSPACE* keys as short-cuts to insert or delete objects respectively.

You can always click *Cancel* to discard the changes made since you opened the screen, regardless of whether the data on the screen are valid.

Working with multiple selections

Most settings screens that have object browse lists (all settings screens except for the two *General options* screens) also allow multiple objects to be selected and manipulated at once, which allows you to change large numbers of settings very easily and quickly. For example:



You can select multiple objects in a screen's left-hand browse list in any of the following ways:

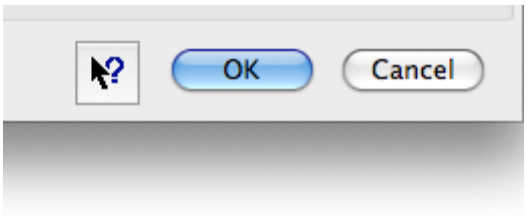
- Drag the mouse across the range of objects you wish to select, if the objects are sequential.
- Highlight the first object, then hold down *SHIFT* and click on another object to select all of the objects in-between.
- Hold down the *COMMAND* (Mac OS X) or *CONTROL* (Windows PCs) key while clicking on an object to add or remove it to/from the current selection.
- Press *COMMAND+A* (Mac OS X) or *CONTROL+A* (Windows PCs) to select all objects.

Even if more than one object is selected, (only) one of the selected objects (usually the last one you selected) is the *current* object, and the right-hand pane shows its properties. However, if a given property has several different values for the various selected objects, then the property is shown in ***bold italic text***. When multiple objects are selected, you can change a property for all selected objects at once by simply changing the property in the right-hand pane.

For example, on the *General settings | MIDI input paths* screen, you could change the MIDI port used for all paths at once by simply highlighting all of the entries in the left-hand pane and then changing the MIDI port setting in the right-hand pane. The *General settings | Switch (MIDI) inputs* and *Organ | Load organ, adjusting rank audio output routing* screens are screens for which this is particularly useful, since those screens have a lot of settings and selecting multiple objects allows large numbers of settings to be changed very quickly and easily.

Getting help on screens and settings

Just to the left of the *OK* button on each screen is a pointer/question-mark icon:



Click on that icon. The appearance of the mouse pointer will then change to a pointer/question-mark or hand. Now click on a blank part of the settings screen. The mouse pointer will change back to its normal appearance but detailed help for the screen will pop up. You can also get detailed help on any specific setting by using the same procedure to click on the setting in question. We do not describe all of the settings in this guide, and merely give an overview of functional areas and screens; **you must use the question-mark help in conjunction with this guide since this guide does not contain detailed help for the settings screens**.

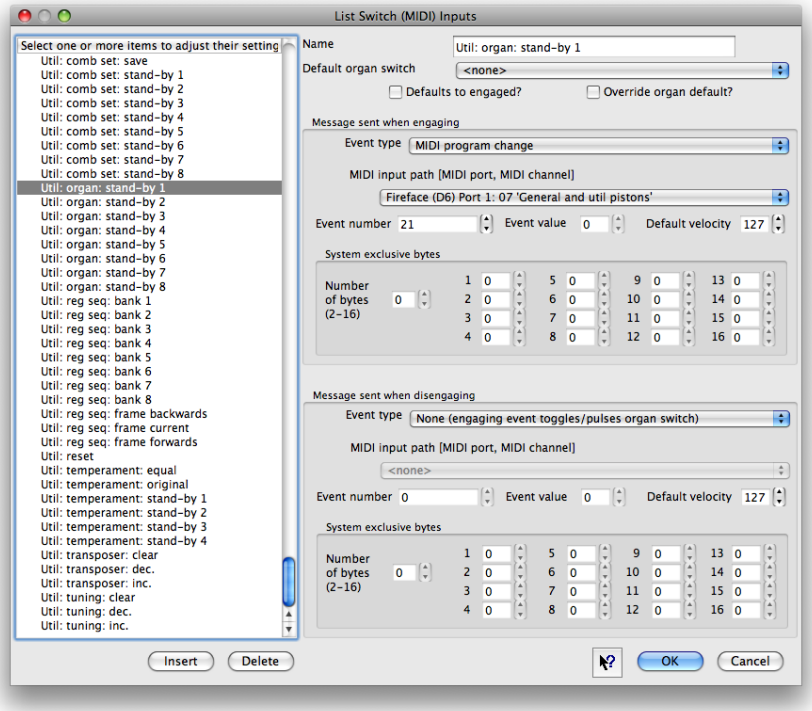
A brief pop-up hint is also displayed for some settings when your hover over them with the mouse.

Menus

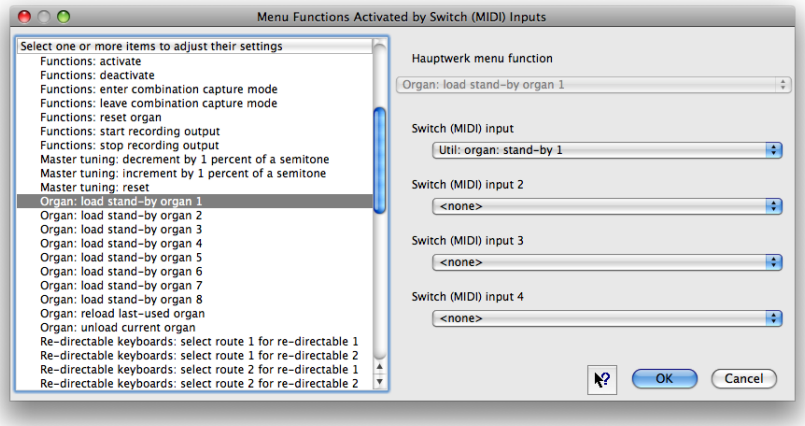
Almost all of Hauptwerk's menu functions can be configured to be triggered by MIDI. (Those that require browsing for a file or a prompt are the exceptions, together with the settings screens.) For example, you could set up a MIDI push-button to load a particular organ, select a particular temperament or set of combinations, or shut the computer down. Thus you can operate Hauptwerk fully without the need for a computer monitor, mouse or keyboard.

Similarly, you can also assign computer keys to trigger menu functions as well as virtual organ controls.

The *General settings | Switch (MIDI) inputs* screen is used in both cases to define the triggering events as properties of a logical 'switch input' (a logical representation of your MIDI switch or computer key):

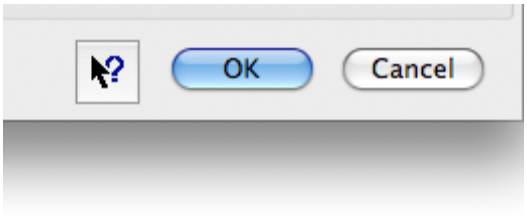


You then use the *General settings | Menu functions activated by switch (MIDI) inputs* to define which menu function should be triggered by the logical switch input:



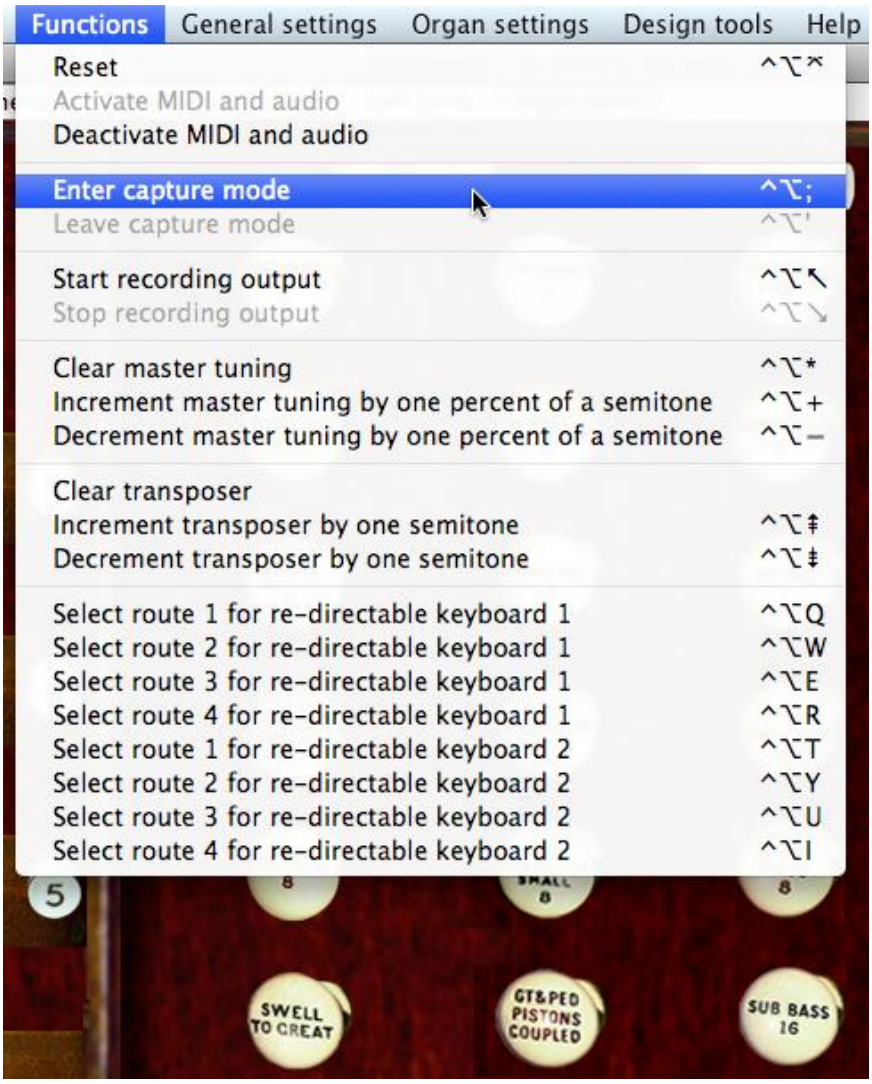
If you wish you can select several switch (MIDI) inputs to trigger any given menu function. This might be useful, for example, for registration sequencer controls, where you might want a toe piston and a thumb piston both to be able to trigger the 'next frame' function.

As with all of Hauptwerk's setting screens, click on the pointer/question-mark icon immediately to the left of a screen's *OK* button:



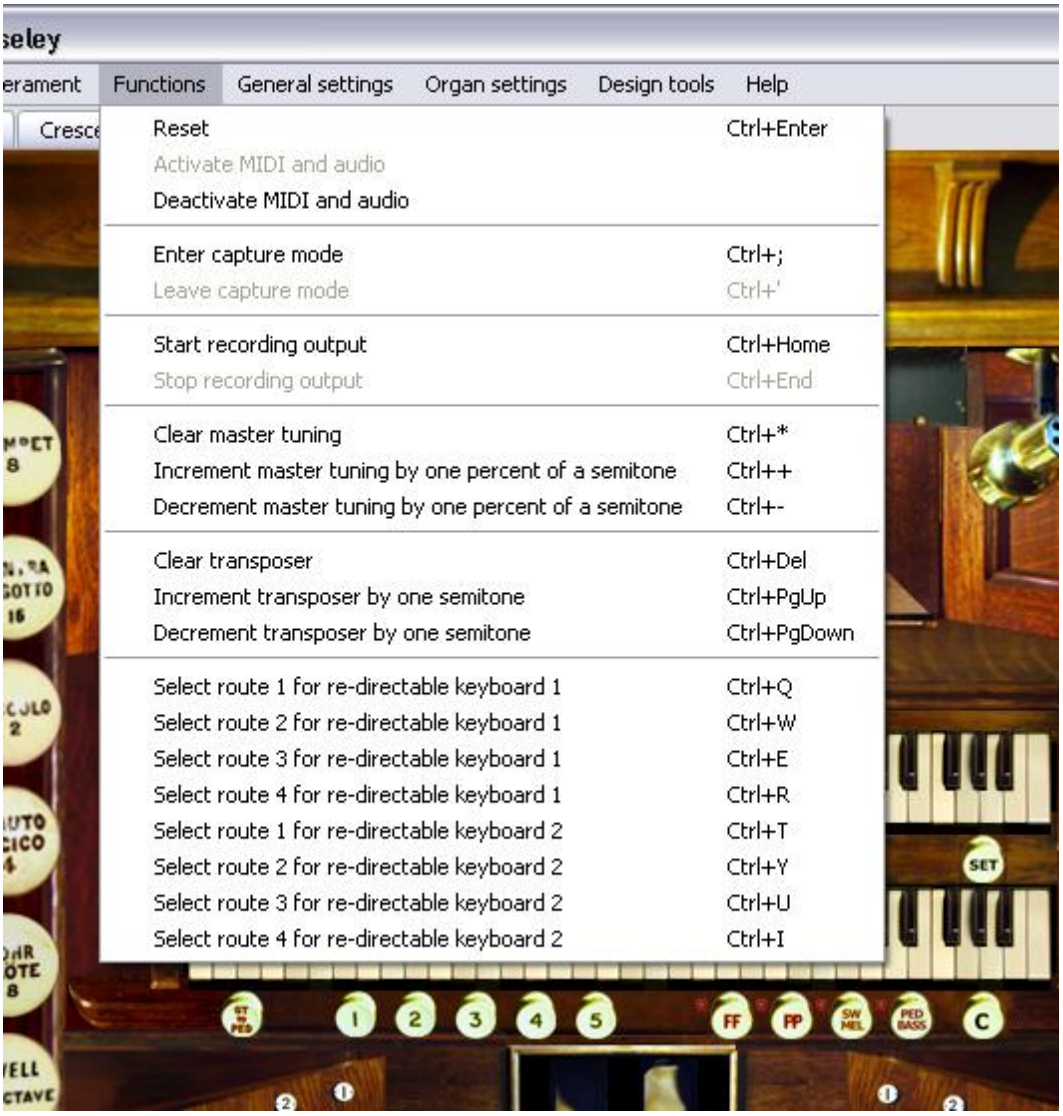
... then click onto the screen background or a specific setting for a detailed explanation of its function.

Finally, in the stand-alone and MIDI sequencing configurations of Hauptwerk, the commonly-used menu functions also have 'accelerator key combinations'. These are additional short-cut key combinations that can always be used to trigger the menu functions from the computer keyboard. Each key combination is shown to the right of its associated menu item:



On an Apple Mac, the *Control* and *Alt* (*Option*) keys are used in combination with another standard key. For example *Control + Alt + F1* loads the first stand-by organ. On a Windows PC the *Ctrl* key is instead used in combination with the

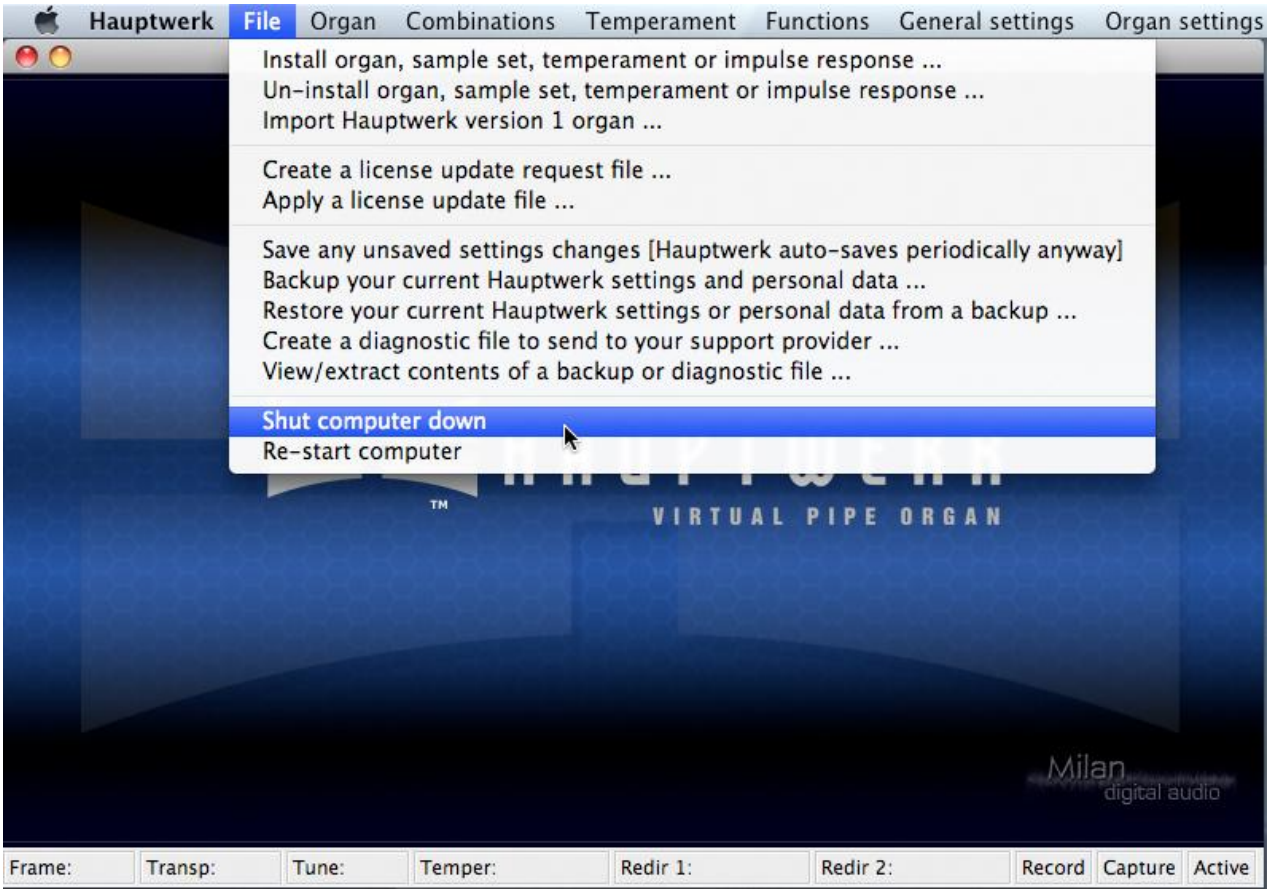
short-cut key. Most screen-shots in this guide, including that of the *Functions* menu above, show Hauptwerk running on an Apple Mac. On a Windows PC the *Functions* menu looks like this:



The File menu

Although various types of files are used by Hauptwerk, most are handled transparently using options found under other menus.

Hence there are only a few items within the *File* menu:



Component installation/import functions

Install organ, sample set, temperament or impulse response and the corresponding *Un-install* option are used to access Hauptwerk's component installer, which reliably and safely handles installation, upgrading, re-installation and deinstallation of all third-party components in Hauptwerk version 2 format and above, such as additional Hauptwerk sample sets. It also ensures that dependency requirements are met. It is the subject of a later section of this guide.

The *Import Hauptwerk version 1 organ* function is covered in the importing version 1 organs section.

Settings save/backup/restore and diagnostic file functions

It should never be *necessary* to use the *Save any unsaved settings [Hauptwerk auto-saves periodically anyway]* function. Hauptwerk always saves any unsaved settings or voicing changes when it exits, and also when you load or unload a sample set, and also before performing any other action that might risk a computer problem being encountered, such as starting an audio or MIDI driver or loading a large amount of data into memory. This menu function is mainly provided just in case you

want to force any settings or voicing changes to be saved immediately, rather than waiting for the next point at which Hauptwerk would save them, for example if you were worried about the possibility of a power failure.

Saving the settings risks an audio glitch, which is why Hauptwerk normally waits until you unload a sample set or deactivate the audio/MIDI systems before saving any voicing changes. To emphasize: any settings or voicing changes you make will always be saved anyway, without needing to use this function. The function just allows you to force them to be saved immediately.

The *Backup your current Hauptwerk settings and personal data* function makes a backup copy of all of your Hauptwerk settings and other personal data (organ combinations, voicing, Custom Organ Design Module organs and log files) into a single compressed file, which can be written to CD/DVD or emailed easily. You can then easily restore that backup at a later date if you ever need to by using the *Restore your current Hauptwerk settings or personal data from a backup* menu function. Please see the backups section of this guide for full details and instructions to make or restore backups.

Important note 1: **Please use the backup function periodically**, and especially once you have configured Hauptwerk as you want it, and then whenever you have made a significant number of changes to your settings, organ combinations, voicing or other personal data in the future. Please store any backup files you make securely somewhere external to your computer, in case your computer's hard-disk needs to be re-installed for any reason. For example, write any backup files you make to DVDs or CDs and keep them in a safe place. You should then easily be able to get all of your Hauptwerk settings and personal data back again at any point in the future.

The *Create a diagnostic file to send to your support provider* function is covered in full in the troubleshooting section of the guide.

Important note 2: **Please always send a diagnostic file** to your support provider if you need to contact him or her for support. That will allow him or her to see your log file, your main Hauptwerk settings and various other Hauptwerk settings and files that are essential for diagnosing most problems quickly and easily.

The *View/extract contents of a backup or diagnostic file* function is provided mainly for use by support providers and sample set providers to allow them to extract and view the contents of diagnostic files or backups that their users have sent to them. It would not normally be used by end-users. However, there might be occasions in which advanced computer users might wish to examine the contents of a backup they have previously made without restoring it. The function simply extracts all of the files stored within a selected diagnostic file or backup into sub-folders of the folder containing the selected file.

License update functions

The *Create a license update request file* and *Apply a license update file* options on the menu should **only be used when specifically instructed by Milan Digital Audio or your Hauptwerk or sample set vendor**. They are used to allow us or a vendor to update your Hauptwerk USB key remotely if you buy certain additional third-party sample sets, or if you upgrade your Hauptwerk license.

You will be contacted with exact instructions for the procedure if your Hauptwerk USB key needs to be updated in that way. The update process is simple and takes only a few moments, but the update may fail and need to be repeated if it is not performed as described in the instructions sent to you.

Note that you need to be able to send a small file from your Hauptwerk computer, and to receive another small file back (each less than 10 KB) onto your Hauptwerk computer in order to update your Hauptwerk USB key. Usually these files are sent by email. However, if your Hauptwerk computer is not connected to the Internet, you can simply save them to a write-able CD, floppy disk or USB memory stick to transfer them between your Hauptwerk computer and another computer that has Internet access.

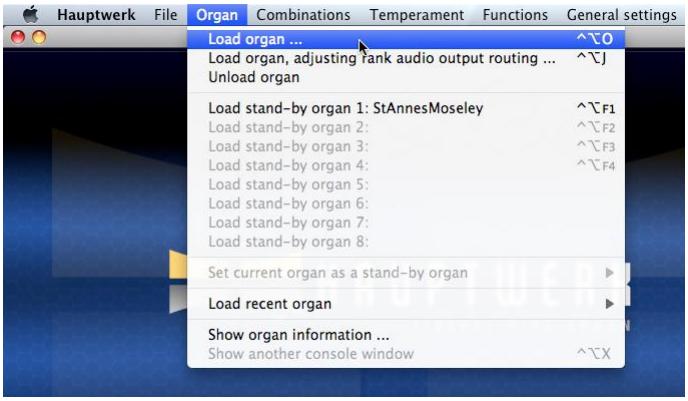
Exit and shut-down functions

The *Shut computer down*, *Re-start computer* and *Exit* (Windows PCs only) are self-explanatory. The first two of them are included mainly so that they can be triggered by MIDI when Hauptwerk is used from a MIDI organ console without a computer monitor. These functions are not available in plug-in (VST or AudioUnit) versions of Hauptwerk.

Loading instruments

Basics

The organ menu is used to load and unload sample sets:

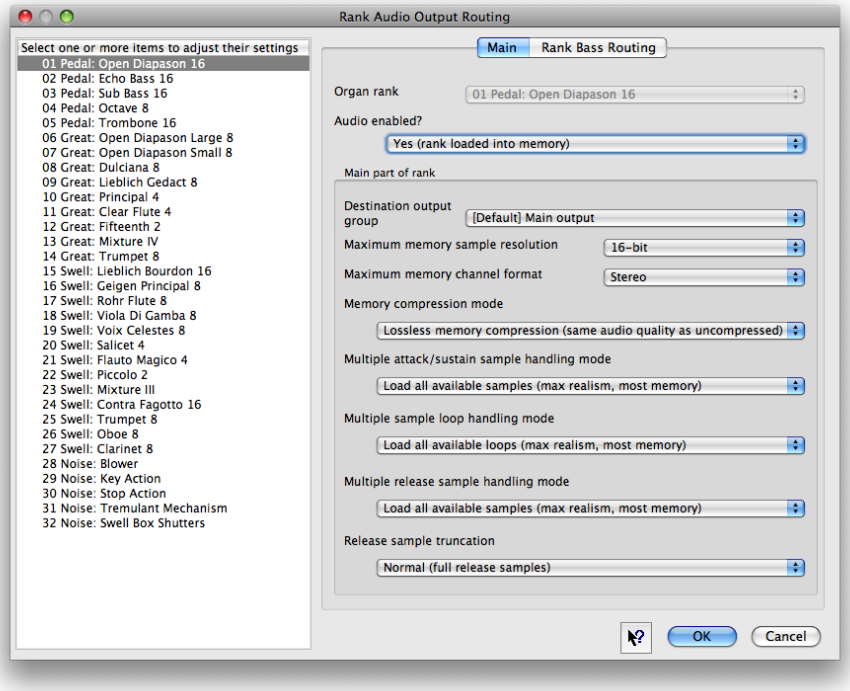


In order to be able to play Hauptwerk, a sample set must be installed and loaded.

The St. Anne's, Moseley organ sample set is installed automatically with Hauptwerk, but you can purchase many other superb additional sample sets from third-parties (see the Hauptwerk website for a list). Before you can load any such additional sample sets, you must install them using Hauptwerk's component installer via the *File | Install organ, sample set, temperament or impulse response* menu option. The component installer is covered in a later section. *(Hauptwerk version 1 sample sets must instead be imported, which is covered in the importing version 1 organs section.)*

The main option used to load a sample set is the *Load organ* menu option. When selected, you are presented with a list of all sample sets which have been installed, so that you can choose which to load.

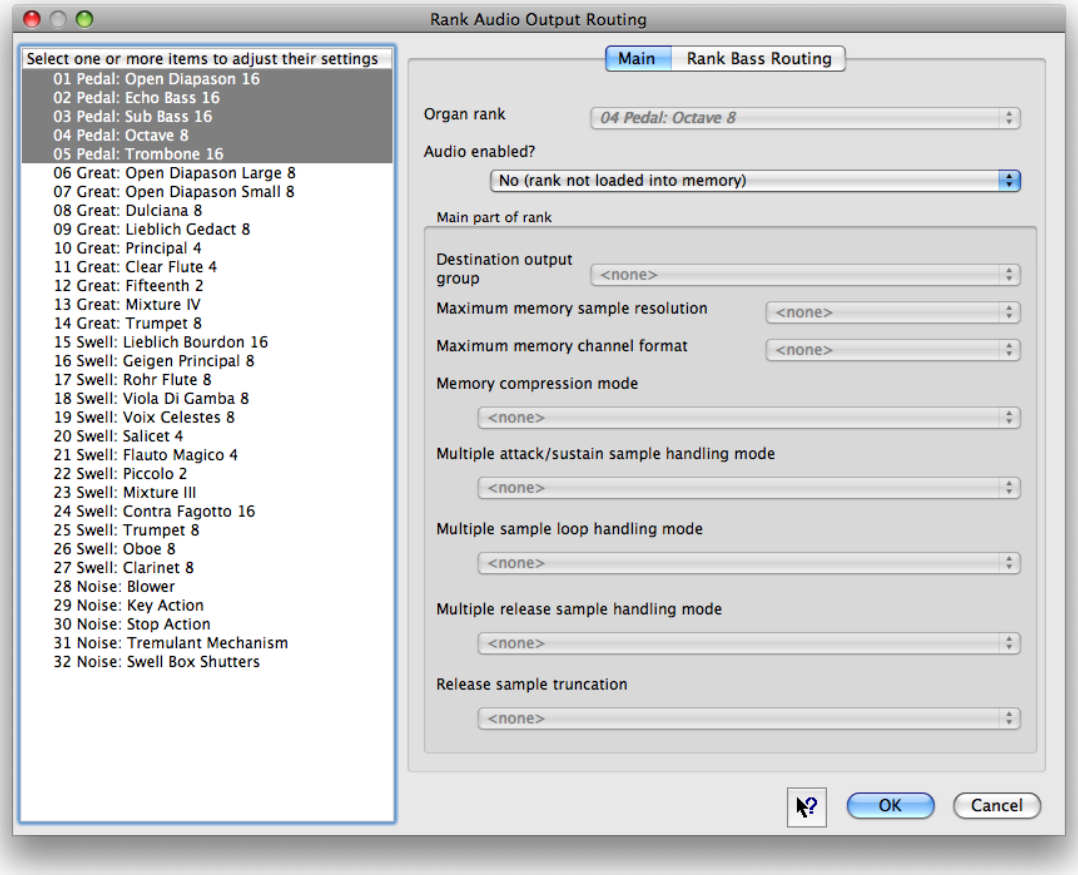
The first time that you load any given sample set, you will be presented with the Rank Audio Output Routing screen:



By default, the screen will not appear again. However, if you wish to change any of the settings subsequently, simply use the *Organ | Load organ, adjusting rank audio output routing* option instead, and the screen will be appear prior to loading, as it did the first time.

This screen can be used to tell Hauptwerk how, and if, each given rank should be stored in memory, and through which of the computer's physical audio outputs it should sound. By setting *Audio enabled?* to 'No', the rank will not be loaded into memory. It is thus possible to load only part of a sample set when you do not have sufficient available computer memory to load all of it.

Note that you can select multiple ranks at the same time (see the settings section), which makes it very quick and easy to change many settings at once. For example:



Rank options: maximum memory channel format

If a sample set uses stereo samples, changing the *Maximum memory channel format* to 'Mono', will cause the sample to be converted to mono prior to loading, and they will then automatically be panned back into stereo in real-time if the rank's selected *Destination output group* is stereo (see the audio routing section). If it is mono, then the samples will always be loaded in mono regardless of the setting. Thus the setting provides a further means to reduce memory requirements drastically, although often at the expense of realism.

(Note that panning mono samples into stereo in real-time is less processor-intensive than playing true stereo samples in the current version of Hauptwerk, unlike Hauptwerk version 1. Note also that the St. Anne's, Moseley organ sample set uses mono, 16-bit samples.)

Rank options: maximum memory sample resolution

The *Maximum memory sample resolution* setting works similarly for sample resolution. Regardless of the setting, a 16-bit sample will never be loaded into memory as a 24-bit sample, but any higher resolution samples will be loaded in 24-bit (32-bit aligned), consuming twice as much memory as 16-bit samples, if the 24-bit option is selected. Note that Hauptwerk's internal audio signal processing and mixing resolution is always 32-bit, and audio output always happens in the highest resolution supported by the computer's audio interface, so even if all ranks are loaded in 16-bit, the effective resolution is

usually still much higher. 14 and 20-bit resolutions only offer any advantages if memory compression is enabled, since they compress much more than 16 and 24-bit respectively, thus saving a large amount of memory.

The 20-bit option is especially useful since it gives most of the audible benefits of a 24-bit resolution, but without using much more memory than loading in 16-bit without compression. Note that you might notice more hiss with the 14-bit option, due to the limitations of the lower resolution. However, it might, for example, be a useful choice for some ranks for which only a few pipes will sound at once, such as softer Pedal ranks.

The smallest Free Edition of Hauptwerk works fully with sample sets of any resolution, but allows samples to be loaded into memory in a maximum resolution of 16-bit.

Rank options: memory compression mode

Memory compression mode allows you to disable loss-less memory compression for some or all ranks, typically increasing the memory required for a given rank by between 40 and 70 percent. Memory compression is enabled by default for all ranks when you load an organ for the first time. Disabling memory compression has no effect at all on audio quality but reduces the load on the computer's processor slightly, increasing the polyphony that can be achieved by between 10 and 15 percent. Hauptwerk's polyphony management system automatically takes this into account.

For most fairly recent computers the slight reduction in polyphony resulting from memory compression would not be a problem. If a sample set easily fits into memory and your processor is struggling to provide the polyphony you want, try disabling compression. If you need to increase polyphony but there is insufficient free memory to disable memory compression for all ranks, try disabling it only for ranks that place the highest demand on polyphony but leaving it enabled for those that place the least demand on polyphony, such as Pedal division ranks where typically only one pipe would sound at a time, or leaving it enabled for those ranks that are used least frequently.

Rank options: multiple loops

Hauptwerk supports samples containing multiple loops, which it plays in a complex sequence to reduce perceived repetition. For the most realistic results, always leave *Multiple sample loop handling mode* set to 'Load all available loops (max realism, most memory)' if you have enough memory to load the whole sample set, so that all loops available in the rank's samples are used. The setting has no effect on samples with only one loop. If you select 'Load only loop which ends first (less realism, less memory)' then usually considerably less memory is required if the samples contain several loops. If a sample set is only slightly too large to fit into memory, try loading only the first loop for the least frequently-used or least prominent ranks. Note the multiple sample loop playback can also be disabled globally using the *General settings | General options* screen.

Rank options: multiple releases

Hauptwerk also allows a sample set to include multiple real release samples for each pipe, which gives extremely realistic handling of releases, especially when playing fast passages. For the most realistic results, always leave *Multiple release sample handling mode* set to 'Load all available samples (max realism, most memory)' if you have enough memory to load the whole sample set, so that all release samples included in the sample set are used. The setting has no effect on pipes with only one release sample. If you select 'Load only default sample (less realism, less memory)' then usually considerably less memory is required if the sample set contains multiple release samples, but the virtual acoustic of the organ will sound much less convincing when playing short notes.

Rank options: multiple attacks

The *Multiple attack/sustain sample handling mode* setting works similarly for sample sets with several attack/sustain samples per pipe. Multiple attack/sustain samples are used in some sample sets to model a pipe organ tracker-action

response, to select samples randomly to reduce repetition, to give more realistic attacks to a pipe that sounds immediately after it has stopped speaking, and to give other improvements in realism. However, if you don't have sufficient memory to load the whole sample set, it is generally best to disable multiple attack/sustain samples in preference to disabling multiple release samples, since multiple release samples give the most obvious improvement in realism.

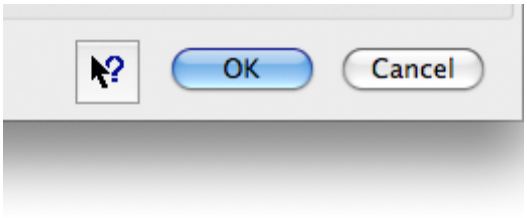
Rank options: release sample truncation

Release sample truncation causes Hauptwerk to truncate release samples artificially, using specially-shaped frequency-dependent decays, to simulate 'dry' samples (with no reverb). With very 'wet' sample sets, which have long release samples, simulating dry samples in this way can save a considerable amount of memory. It can also allow such sample sets to be played in reverberant spaces and helps to reduce noticeable differences in acoustics when using sample sets containing samples drawn from several different sources. However, the results are never completely the same as using true dry-recorded samples, mainly because a room acoustic also affects the attack and sustaining portions of the sound, which simple truncation of releases cannot model. True dry samples are thus highly preferable to using this option, and it is recommended that it only be used as a last resort. The licenses for some sample sets do not allow modification of samples in this way, and this option is disabled for such sample sets.

Rank options: destination output group

The *Destination output group* setting refers to audio output groups created and maintained by the *General settings | Audio output groups* screen, and is the means by which multi-channel audio output is configured - see the audio routing section). It is only relevant if your computer has an audio interface that has multiple physical audio outputs which can be accessed independently (often not the case with surround-sound sound cards).

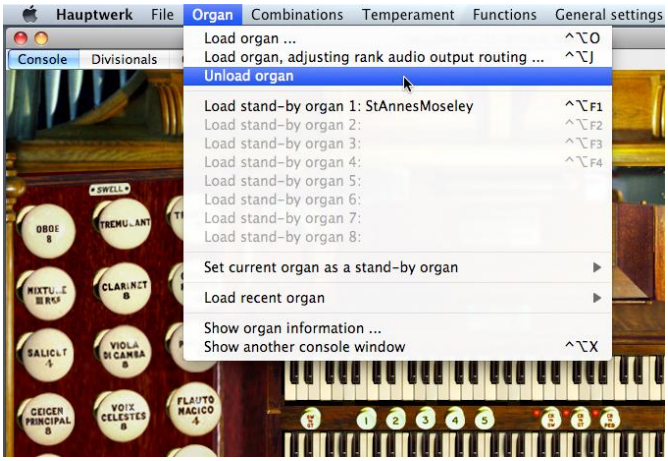
Click on the pointer/question-mark icon immediately to the left of a screen's *OK* button:



... then click onto the screen background to get additional help information about the screen as a whole, or onto any given setting for help on that setting. The same is true of almost all screens in Hauptwerk.

Other menu options

Continuing with the other menu options in the *Organ* menu, the *Organ | Unload organ* menu is used to unload the sample set, freeing up the memory it occupied:



If you have loaded at least one sample set previously, the *Organ | Load recent organ* sub-menu will list those most recently accessed, providing a convenient short-cut to recall them.

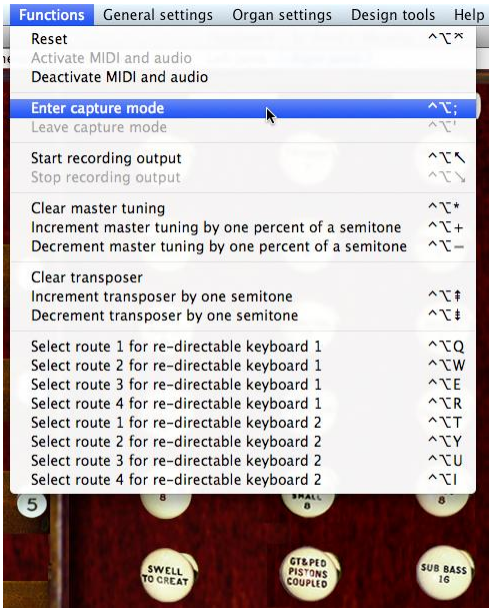
When a sample set is loaded, the *Organ | Show organ information* option opens documentation specific to the sample set that has been provided by the creator of the sample set. Typically, this will include photographs of the original recorded instrument, history and other background information.

If you have the Advanced Edition of Hauptwerk you can open up to four virtual console display tabs (pages) at once in separate windows using the *Organ | Show another console window* menu function:

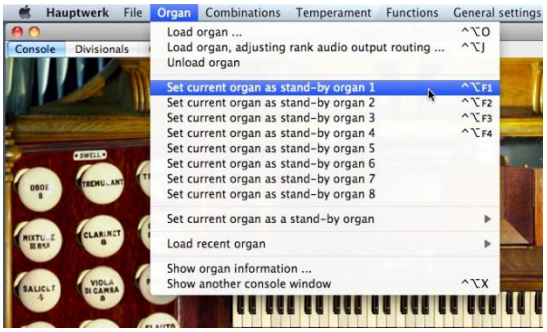
This is most useful if your computer has two or more touch-screen monitors attached to it. For example, you could display

one window (display tab) on a monitor to the left of your MIDI keyboard(s) and another to the right to give a traditional organ console layout with some stops on either side of your MIDI keyboard(s) when using sample sets that have their virtual console tabs laid out in that way.

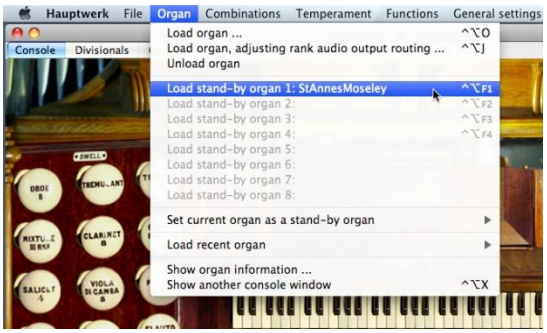
With a sample set loaded (such as the St. Anne's, Moseley organ), select *Functions* | *Enter capture mode* from the menu:



Now go to the Organ menu. Select Organ | Set current organ as stand-by organ 1:



Then select *Functions* | *Leave capture mode*. Now go back to the *Organ* menu. Note how seven of the eight stand-by organ entries are grayed out again, but that the sample set you have loaded now appears on the menu in the first 'stand-by' organ position:



From now on you can always select the sample set directly from the menu with this option. However, the main benefit of assigning a sample set to the menu in this way is that it can be recalled uniquely via MIDI, or from computer keyboard key short-cuts. Thus you can have up to eight sample sets assigned directly to the menu, and you can have up to eight external MIDI switches (usually push-buttons) configured to recall them. If you are using Hauptwerk from a sequencer rather than a MIDI organ console, you can even make Hauptwerk load the required organ by including the appropriate MIDI message at the start of a track (although that may be inconveniently slow).

If an organ is loaded, you can also assign it directly to one of the eight stand-by 'slots' using the *Organ* | *Set current organ as a stand-by organ* sub-menu. These menu functions avoid the need to enter and leave capture mode, but can only be accessed from the menu. They are short-cuts provided for convenience.

When a sample set is loaded, its name appears in the title bar of the main Hauptwerk window.

Combination files

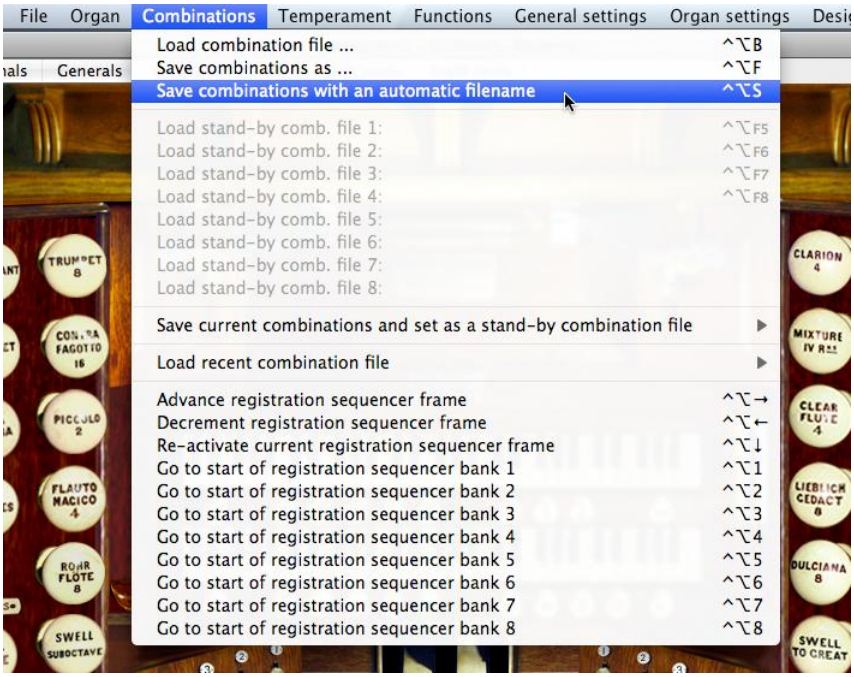
As discussed previously in the section on the virtual console, Hauptwerk supports adjustable combinations, being sets of saved registrations that can be recalled. Those combinations can be saved to *combination files* so that many different full sets can be stored, appropriate for different pieces of music or recitals, for example, and they can be loaded back into the virtual organ when needed. Each combination file contains the set of registrations stored for all of the virtual combinations provided by the virtual organ (usually divisional and general combination pistons plus possibly a crescendo), as well as the registrations stored for all of Hauptwerk's registration sequencer frames for the sample set.

Each combination file could be thought of as a 'bank' of combination memories. Note that combination files are not themselves combinations; loading a combination file will not affect the registration immediately. You must still trigger a combination piston or select a registration sequencer frame for the registration to be affected.

The *Combinations* menu is used to load and save these combination files and to access Hauptwerk's registration sequencer, and is only enabled when a sample set is loaded. Use of the sample set's combinations is covered in the section on the virtual console.

Combination files are specific to the sample set loaded, and you will only be shown files that are appropriate for it when loading such a file.

Load a sample set, such as St. Anne's so that the menu is enabled:



The *Combinations | Save combinations as* and *Combinations | Save combinations with an automatic filename* can now be used to save a combination file. The former allows you to specify a filename and is the most useful when you are operating the computer directly. However, the latter can be triggered by MIDI, and so is most useful when Hauptwerk is being used without a computer monitor or keyboard.

Having saved a combination file, try loading it back into Hauptwerk using the *Combinations | Load combination file* menu options. You can subsequently use the *Combinations | Load recent combination file* sub-menu as a short-cut to the file if

you wish. Note that it may take a few seconds for a very large combination file to be loaded so you should not attempt to load a file while actually playing a piece of music; load it between pieces. However, most combination files load almost instantaneously.

Combination files can be assigned to the eight 'stand-by combination file' slots on the menu in a similar way to sample sets on the *Organ* menu (see the section on loading sample sets), in that they recall the files when Hauptwerk is not in capture mode, but assign the current file to the menu when in capture mode (*Functions | Enter/Leave capture mode*). However, since the current combinations need to be saved to a file before they can be assigned to such a menu slot, when the menu item is selected while Hauptwerk is in capture mode it automatically saves the combinations to a file with a generated filename (as for *Combinations | Save combinations with an automatic filename*), and then assigns that file to the menu slot.

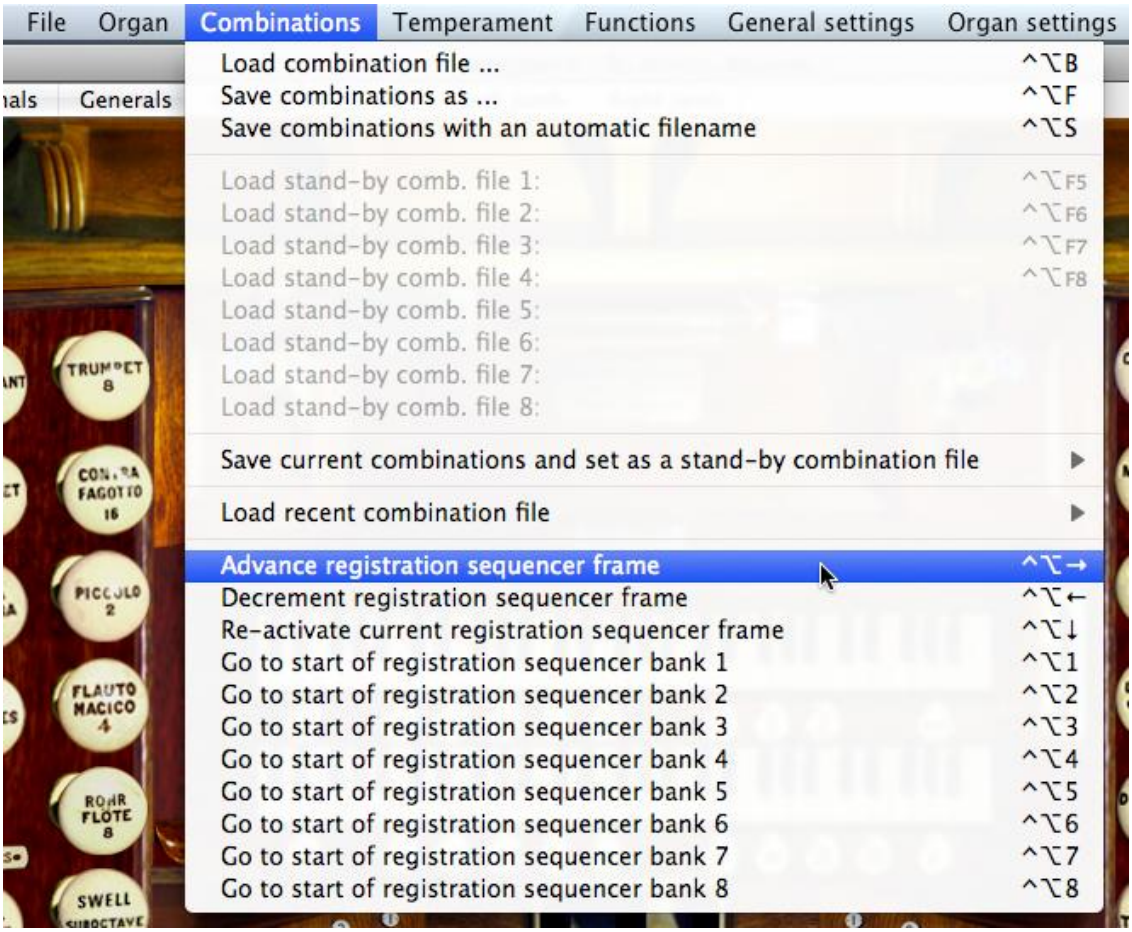
Thus the eight stand-by slots can be used conveniently via MIDI. For example, you could have eight MIDI buttons for the eight slots, and use them to load and save the combination files, together with an additional momentary MIDI piston for capture mode. Depending on how you had configured the MIDI capture piston, you might hold in the piston and press one of the eight combination buttons to save all combinations to it (effectively a complete 'bank' of combinations), or press one of the eight buttons without the capture piston held in to re-load its set of combinations.

Similar to the *Organ* stand-by assignment sub-menu, combination files can also be saved and assigned directly to a stand-by slot using the *Combinations | Save current combinations and set as a stand-by combination file* menu short-cuts, avoiding the need to enter and leave capture mode.

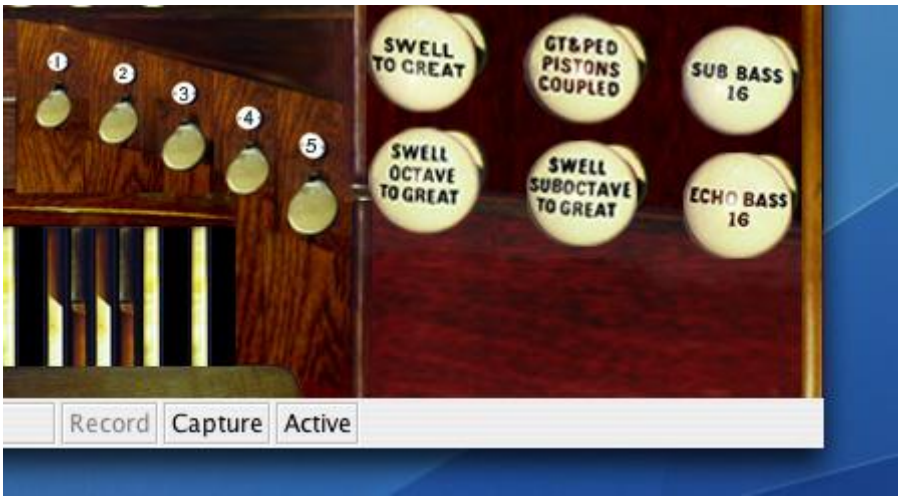
The registration sequencer

Registration sequencer frames are 'invisible' general combinations, and are always saved into combination files. A maximum of 512 can be recorded. The current frame number is displayed in the status bar along the bottom of the main Hauptwerk window:

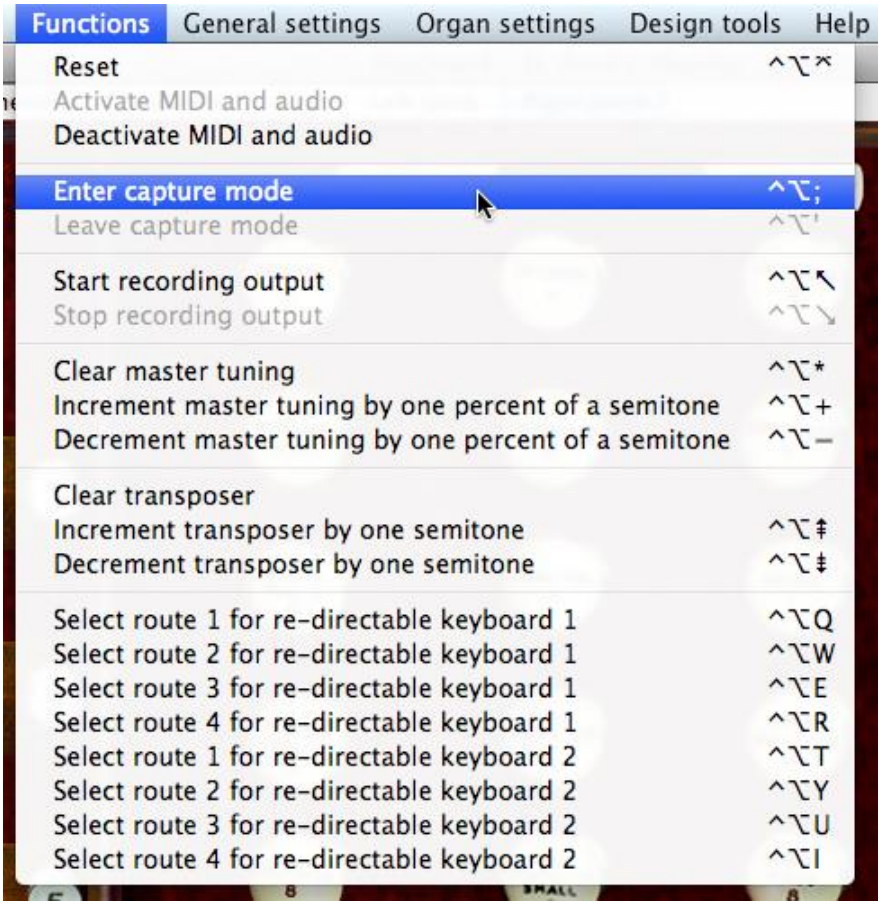
When a sample set is loaded, all registration frames are empty, and changing the current frame will have no effect upon the current selected registration. You can capture the state of all virtual console switches (stops, couplers, tremulants, etc.) to the current frame by using *Combinations | Re-activate current registration sequencer frame* while in capture mode. You can advance and decrease the frame number using the *Combinations | Advance/Decrement registration sequencer frame* menu options. If Hauptwerk is in capture mode while either of the advance/decrement options is selected, Hauptwerk will capture to the next or last frame and make it current. If it is not in capture mode, it will recall the registration:



The capture mode status is also displayed in the status bar at the bottom-right of the main window:



Hence to record a sequence of registration changes for a performance, you would set the virtual switches to their positions for the beginning of the performance and enter capture mode:



... then select *Combinations | Re-activate current registration sequencer frame*. Remaining in capture mode, you would then make the first set of registration changes, then select *Combinations | Advance registration sequencer frame*, and do likewise for all subsequent changes. When all registrations were recorded, you would then leave capture mode.

The 512 frames available are considered organized as eight consecutive banks of 64 frames. You can use the *Combinations | Go to start of registration sequencer bank 1-8* functions to jump to the start of any of the banks. For example, if you jump to the start of the third bank, your active frame number would become (3 x 64) + 1 = 193 (plus 1 because frame numbering starts at 1).

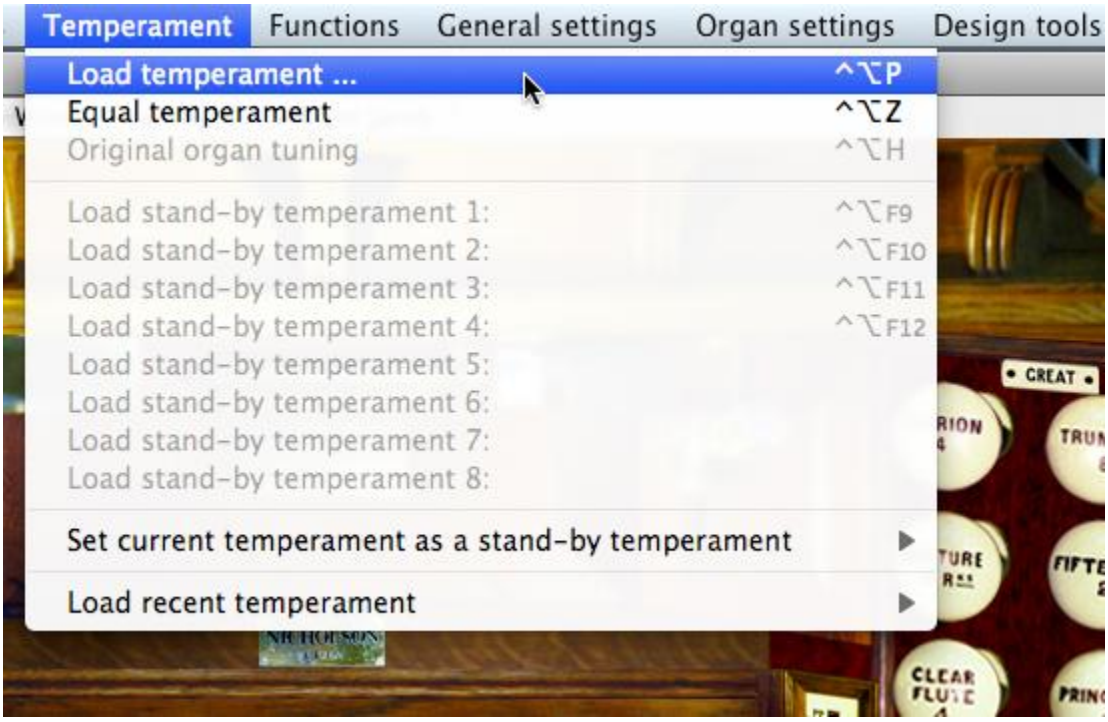
You could use one bank for each piece in a recital, for example.

The registration sequencer menu functions can all be triggered by MIDI, and, together with the capture mode, are some of the most useful functions to assign to external MIDI switches for playing convenience.

Temperaments

A temperament is a scheme by which the organ is tuned, and determines the pitch intervals between the pipes for successive notes on the keyboard. With *equal temperament* the interval between each successive note is constant, and so pieces of music can be played in any or several keys while the psychoacoustic effect remains constant. However, other tuning schemes give different effects and may be better suited to different types of music, particularly historical music which often was written for different temperaments.

Hauptwerk allows different temperaments (tunings) to be installed via the component installer, and to be selected and applied to any sample set via the *Temperament* menu:



The menu is only enabled when a sample set is loaded. Note that the menu is disabled, and temperaments cannot be used, if the *Disable interpolation (use fixed-pitch playback)?* option is selected on either of the *General settings | General options* or *Organ settings | General options* screens, since interpolation is required in order that Hauptwerk can control the pitch of the pipes.

Equal temperament is the most common tuning used for modern instruments and is the default when a sample set is loaded into Hauptwerk unless the virtual organ can be played with its real, original tuning. If you have selected a different temperament, you can return to equal temperament using the *Temperament | Equal temperament* menu function.

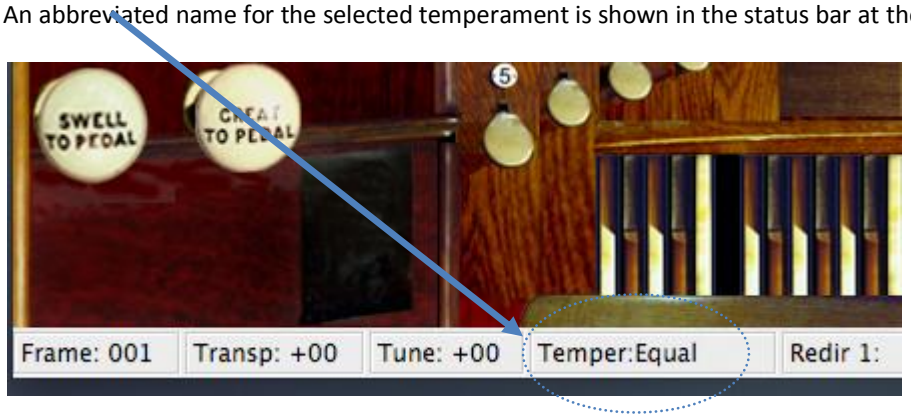
You can load alternative temperaments (tunings) via the *Temperament | Load temperament* option. A number of temperaments are installed with Hauptwerk. The *Temperament | Load recent temperament* sub-menu and eight stand-by menu slots work in the same way as their equivalents on the *Organ* menu; if a temperament is currently loaded it can assigned to a stand-by slot by selecting the slot while in capture mode, and recalled from the slot when not in capture mode. It is thus possible to have up to eight MIDI buttons with which to recall up to eight temperaments.

As with the *Organ* stand-by assignment sub-menu, temperaments can also be assigned directly to a stand-by slot using the *Temperament | Set current temperament as a stand-by temperament* menu short-cuts, avoiding the need to enter and leave capture mode.

If you try playing a chord with equal temperament and then the same chord with another temperament, such as $^{1}/_{4}$-Comma Meantone, you should clearly be able to hear the difference that the temperament makes. The 'Test-DeliberatelyMistuned' temperament can also be used to verify that Hauptwerk's temperaments are working.

Some sample sets can also be played at their original recorded pitches, as an alternative to using a fixed temperament. For such sample sets, the *Temperament | Original organ tuning* option selects that behavior, and is selected by default. The option is only meaningful if the samples have been kept tuned to their original pitches, and were all recorded from a single organ, and the option is not available for St. Anne's.

An abbreviated name for the selected temperament is shown in the status bar at the bottom of the main window:



Finally, note that some sample sets are intended only to be heard exactly as they were recorded and have licenses which explicitly disallow any temperament adjustments. For such sample sets the temperaments menu functions are not enabled.

Audio routing and multi-channel audio

Multi-channel audio output is only relevant if your computer has an audio interface that has multiple physical audio outputs which can be accessed independently (often not the case with surround-sound sound cards), and multiple amplifiers and speakers to drive from them. In such cases, you can route different ranks to different speakers, or groups of speakers, and thus provide a three-dimensional effect, at the same time optimizing the load on the speakers and minimizing distortions within the amplification system. With 'dry' sample sets (no room acoustic recorded into samples) the use of many separate speakers also makes the virtual pipes interact in a much more natural way with the acoustic of the listening room, helping the brain to identify them as separate sound sources and giving much greater perceived clarity.

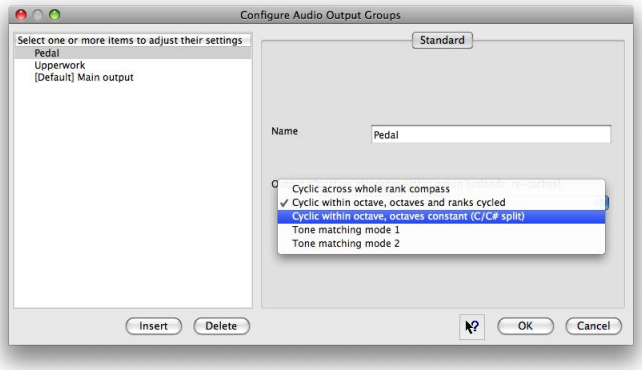
Multi-channel audio output is also only available in the Advanced Edition of Hauptwerk (it is only possible to use more than one mono or stereo output if you are using the Advanced Edition).

We will use an example (by no means optimal) to illustrate how it is configured:

Suppose you have an audio interface with eight physical (mono) analogue audio output channels, such as the Echo Audiofire 8. Suppose that you want two of those channels to be used for Pedal ranks, with output to two separate mono amplifiers and bass speakers, and with the Pedal pipes distributed evenly amongst those two amplifiers. You also want the next four audio channels to drive two stereo amplifiers to which you will route the main pipework, with the pipes being distributed evenly between those two stereo amplifiers. Finally, the remaining two channels will be used for high-pitch ranks, with standard stereo output.

You would need to have three audio output groups in the *General settings | Audio output groups* screen:

- Pedal.
- Main.
- *Upperwork* (high pitched ranks).

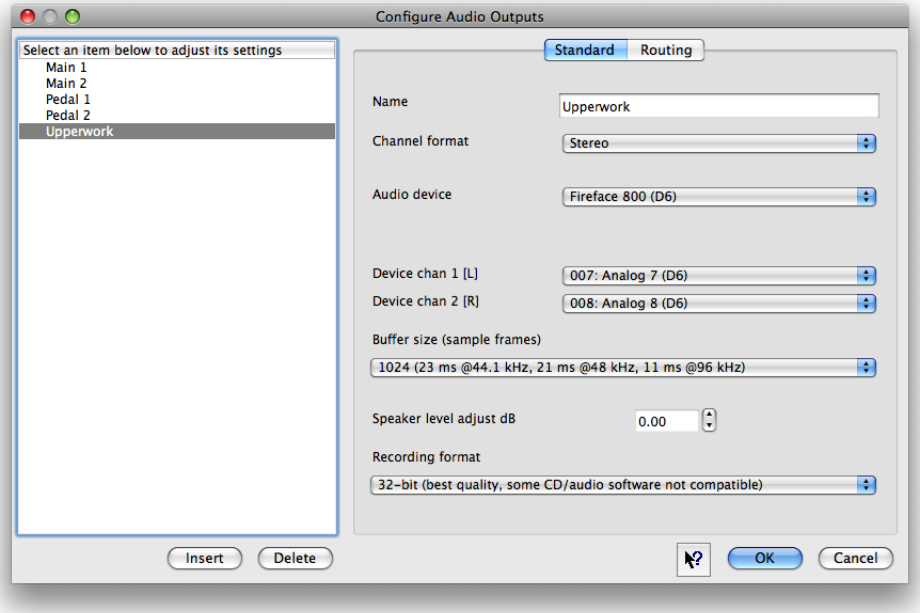


The *Output allocation algorithm within group* setting determines how Hauptwerk will allocate each individual pipe amongst the available logical outputs within the group. For example, if a group contains three mono outputs and the selected algorithm is 'Cyclic within octave, octaves constant', the a C-note pipe will be assigned to the first logical output, a C#-note pipe to the second, a D-note pipe to the third, a D#-note pipe back to the first, and so forth. Other algorithms can give a C/C# split, minimize the chance of any two pipes sounding through the same channel at the same time, minimize speaker intermodulation distortion, and other options.

After clicking OK on the screen you will receive a warning message that some groups do not have any logical audio outputs within them. This is to be expected because they have not been created at this stage.

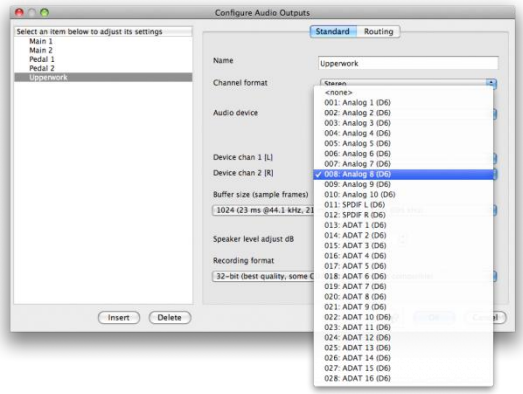
You would then need to use the *General settings | Audio outputs* screen to configure five logical (primary) audio outputs:

- *Pedal 1*, with its audio output group set to *Pedal* and channel format mono.
- *Pedal 2*, with its audio output group set to *Pedal* and channel format mono.
- *Main 1*, with its audio output group set to *Main* and channel format stereo.
- *Main 2*, with its audio output group set to *Main* and channel format stereo.
- *Upperwork*, with its audio output group set to *Upperwork* and channel format stereo.

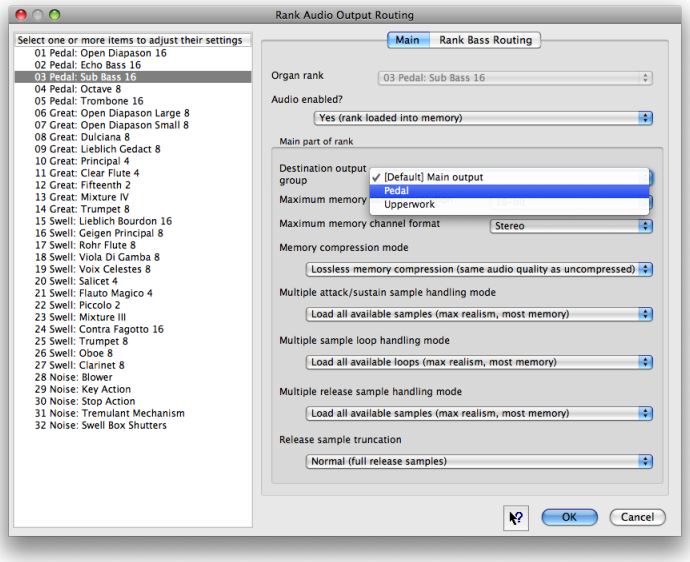


Still on the *General settings | Audio outputs* screen, make sure that the correct audio driver is selected for all entries (the RME Fireface's native driver in this example) and select the audio interface's physical analogue audio output channels for each of the logical audio output channels:

- *Pedal 1*, device channel 1 [L]: *001*.
- *Pedal 2*, device channel 1 [L]: *002*.
- *Main 1*, device channel 1 [L]: *003*.
- *Main 1*, device channel 2 [R]: *004*.
- *Main 2*, device channel 1 [L]: *005*.
- *Main 2*, device channel 2 [R]: *006*.
- *Upperwork 1*, device channel 1 [L]: *007*.
- *Upperwork 1*, device channel 2 [R]: *008*.



You are now ready to load the organ. Load the organ with *Organ | Load organ, adjusting rank audio output routing* so that the routing screen appears. For each of the Pedal ranks set the *Destination output group* to *Pedal* so that its pipes will be distributed evenly amongst the two available mono logical audio outputs, thus sounding in mono. For the high-pitched ranks, select *Upperwork* for the output group so that all of their pipes will be routed to the (only) stereo logical audio output within that group. Finally, select *Main* as the group for all remaining ranks. Because there are two stereo logical audio outputs within the group, the pipes will be distributed evenly between those two outputs, but each pipe will still produce stereo output because the logical audio output is stereo:



To summarize some of the key points so far:

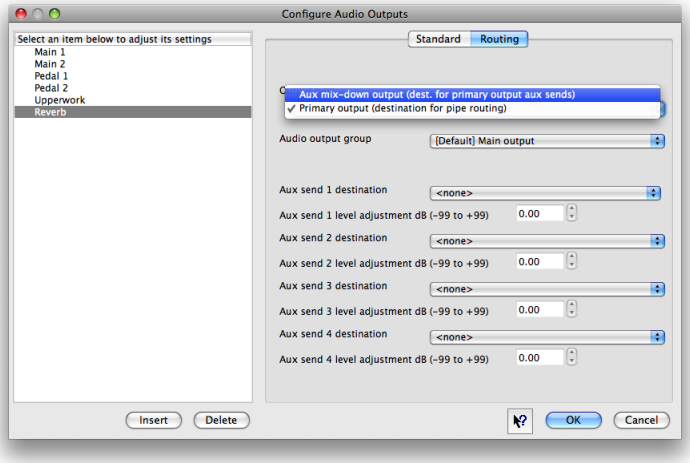
- Ranks are routed to audio output groups.
- Each group must contain one or more logical audio outputs.
- The channel format (mono or stereo) of a logical audio output determines the channel format in which any pipes mapped to it will sound. Note that if a mono sample is played through a stereo logical audio output, it will automatically be panned to stereo in real-time, based on its virtual pipe position.
- If a group contains more than one logical audio output, then its pipes will be distributed amongst the outputs in the group based on the selected allocation algorithm. Note that the mapping happens when the organ is loaded and remains static, so individual pipes do not move between speakers.
- The logical audio outputs map logical channels to individual physical device channels.

(Note that panning mono samples into stereo in real-time is less processor-intensive than playing true stereo samples in the current version of Hauptwerk, unlike Hauptwerk version 1.)

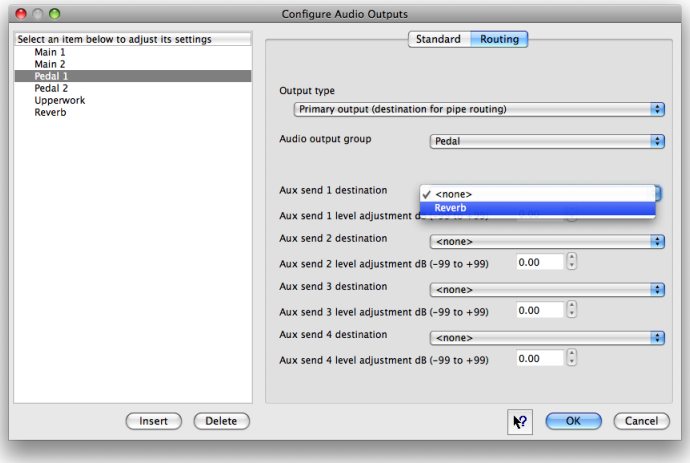
It is also possible to route the lower and upper parts of a rank separately so that, for example, you could route the bottom octave of a rank to an audio output group containing high-powered mono bass amplifiers, and the remainder of the rank to standard full-range stereo amplifiers and speakers. To do so, on the *Rank Bass Routing* tab of the *Rank Audio Output Routing* screen, change the *Main/bass split point note number* from 0 (no split) to 48. 36 is the note number of the bottom C on a 61-note keyboard or a pedalboard, so 48 is the note number of the C one octave above it. You can then use the remaining settings on the tab to select a different audio output group for the bass part, and also to adjust the maximum channel format and resolution, as with the main part.

You can also create additional logical audio outputs which are used to mix down the audio from other logical outputs, forming a virtual mixing desk. This enables you to drive separate mixed-down outputs to be sent to external reverb processors, monitor speakers, headphones, and for recording a mixed-down stereo output from a multi-channel audio system, for example.

To do this, simply create a logical audio output for each such mixed-down output required, and set its *Output type* to 'Aux mix-down output':

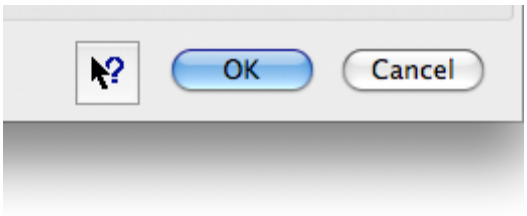


Now for each of the other (primary; non mix-down) logical audio outputs, specify the new mix-down output as an aux send destination on the *Routing* tab:



You can also adjust the level for the send, thus providing different mix balances to different mix-down outputs.

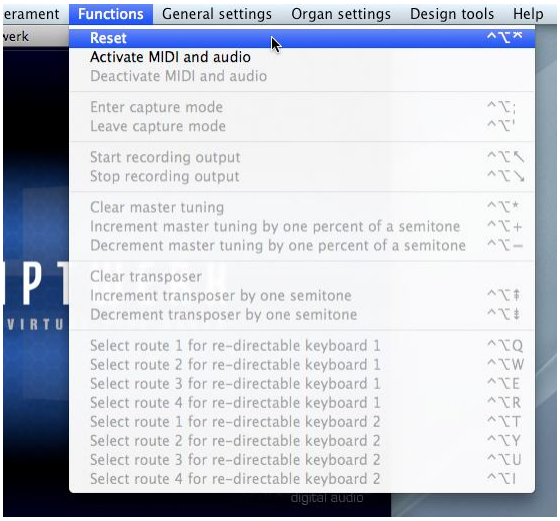
As with all of Hauptwerk's setting screens, click on the pointer/question-mark icon immediately to the left of a screen's *OK* button:



... then click onto the screen background or a specific setting for a detailed explanation of its function. This section in the user guide is only intended to give a very brief overview of the use of the audio screens, and must be used in conjunction with the pointer/question-mark.

Activation and resets

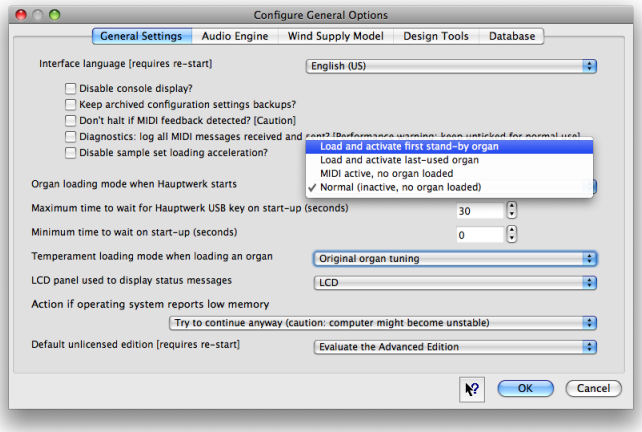
Functions | *Reset* sets the state of all virtual controls and virtual pipes back to their default values when the sample set was loaded:



Functions | *Activate/Deactivate MIDI and audio* start and stop Hauptwerk's MIDI and audio engines respectively and open and close hardware devices configured for use with Hauptwerk. When a sample set is loaded, Hauptwerk attempts to activate automatically, and deactivation usually happens automatically when a sample set is unloaded. Since Hauptwerk usually requires exclusive access to all MIDI and audio devices for which it is configured, you can temporarily deactivate Hauptwerk whilst you use another program that needs to access those devices.

Note that Hauptwerk can be activated when no sample set is loaded. Although only the MIDI systems (not audio) are activated, this allows external MIDI control of Hauptwerk's menu functions, such as loading sample sets, and also for MIDI status information to be sent to an external console (Advanced Edition only), which is useful if Hauptwerk is being used without a computer monitor or keyboard.

Once Hauptwerk has been configured initially, you can set Hauptwerk to activate or load an organ automatically when it starts using the *General settings* | *General options* screen:

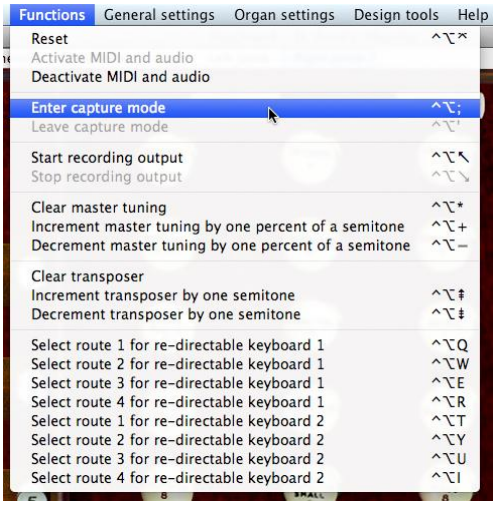


Hauptwerk's active status is displayed in the status bar at the bottom-right of the main window:

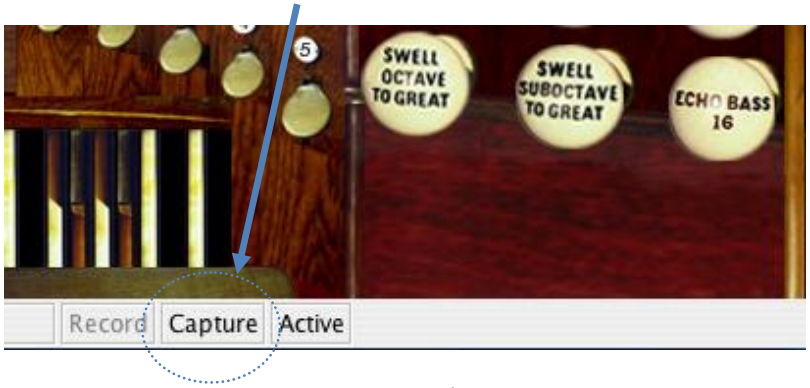
When Hauptwerk is inactive, no virtual console is displayed, even if a sample set is loaded.

Capture mode

The Functions | Enter/Leave capture mode functions have been discussed with regard to the combination system:



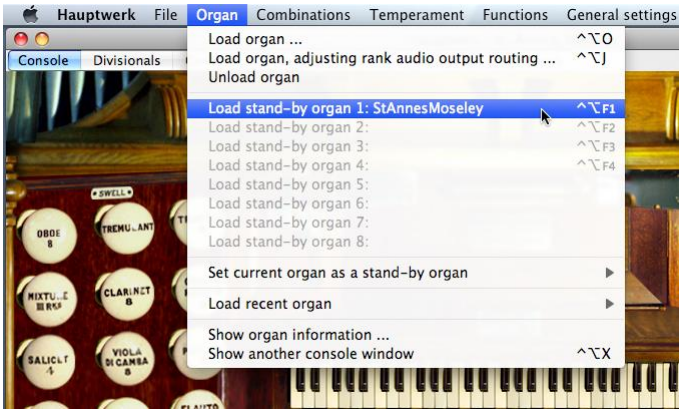
The capture mode status is also displayed in the status bar at the bottom-right of the main window:

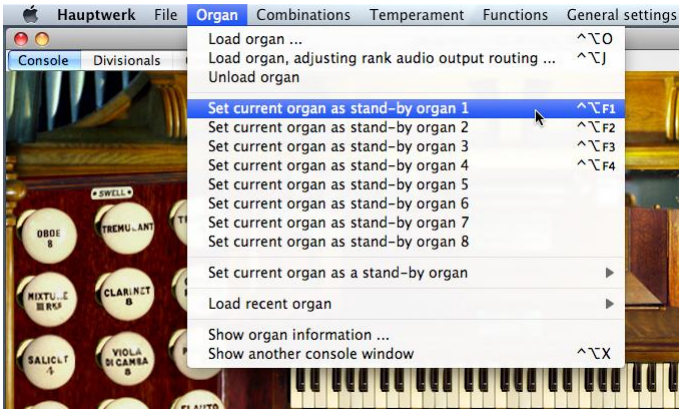


A sample set may include a 'setter' piston/switch, which also enables or disables capture mode.

When in capture mode, activating a virtual combination piston stores the registration within its scope (division or general) to it, whereas activating the piston at other times recalls the stored registration.

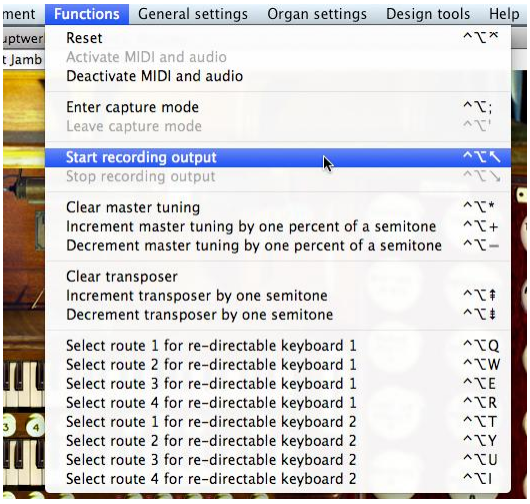
Capture mode also changes the eight stand-by slots on the *Organ*, *Combinations* and *Temperament* menus between recall and assign modes:





The audio recording system

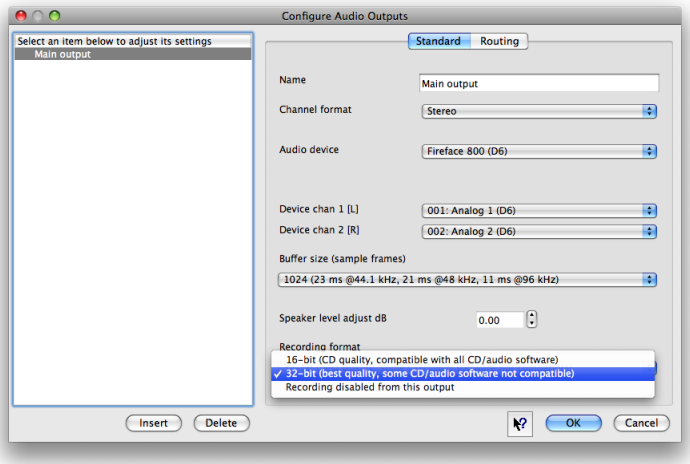
Functions | Start/Stop recording output control Hauptwerk's built-in recording system, and are only available when a sample set is loaded and active:



The built-in recording system provides a simple means to record the sound output produced by Hauptwerk, whilst still allowing it to be heard as normal.

When you start recording, Hauptwerk creates a WAV audio file with a unique generated filename in the *HauptwerkRecordedOutput* folder. The default installation location for the folder is */Hauptwerk/HauptwerkRecordedOutput* on an Apple Mac or *\Hauptwerk\HauptwerkRecordedOutput* on a Windows PC. From that moment onwards, until you stop recording, all audio that is sent to your audio/sound card is also written to the file. You must not open the file until you have stopped Hauptwerk recording.

Using the *General settings | Audio outputs* screen, you can select whether the files will be written with a 32-bit or 16-bit resolution, or whether output recording should be disabled for any given logical audio output:

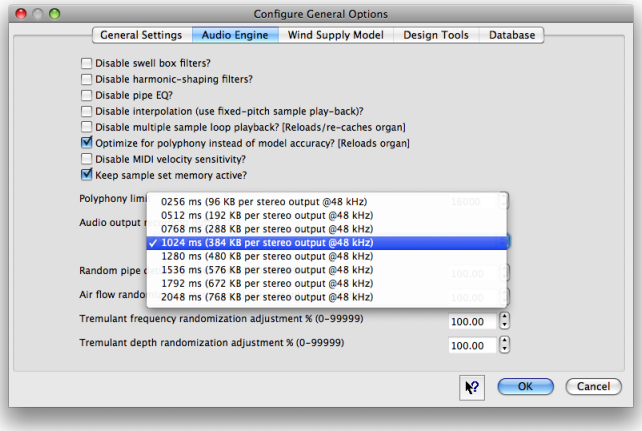


32-bit gives significantly better quality but some CD writing and audio editing software cannot open 32-bit audio, so you should select 16-bit if you find your software falls into that category.

The channel format will depend upon the configuration of the logical audio output (also defined on the *General settings | Audio outputs* screen). If you have more than one logical audio output defined for multi-channel audio output (Advanced Edition only), one file will be created for each logical output, provided that 'Recording disabled for this output' has not been selected as the recording format for the output.

Once you have stopped recording, you can browse to the files using *Finder* (Mac OS X) or *Windows Explorer* (Windows PCs) and open them in a third-party audio editor or audio player program. You can also rename them to give them more meaningful filenames, or delete or move them as you wish.

If you hear any audio glitches in Hauptwerk's output whilst it is recording, or find any glitches in the resulting audio file, try increasing the *Audio output recording buffer size* setting on the *General settings | General options* screen:

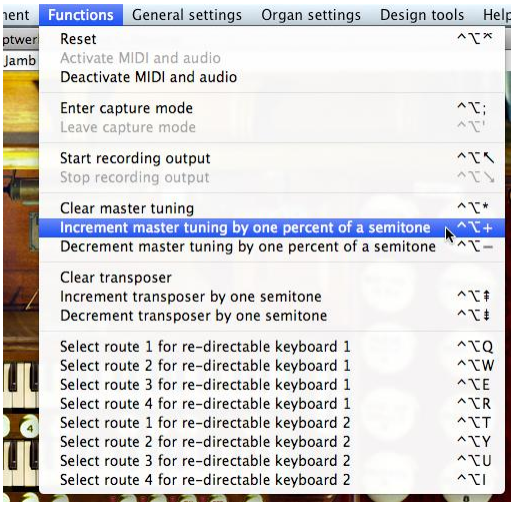


The setting determines the maximum amount of time Hauptwerk allows your hard-disk to write a chunk of streamed audio to disk before an audio glitch will be heard or recorded. The default setting should be fine for most modern hard-disks but if you have an old or slow disk or are recording a lot of audio outputs simultaneously then it might be necessary to increase this setting. Larger values use a little more memory.

Master tuning

Hauptwerk allows its overall tuning to be raised or lowered so that it can be played with acoustic instruments, or other instruments that cannot easily be re-tuned. For example, the master tuning adjustment makes it possible to integrate Hauptwerk with real organ pipework, the tuning of which will change with temperature, and to adjust Hauptwerk's tuning to match.

Functions | Clear master tuning resets Hauptwerk's tuning to standard A-440 tuning (standard concert pitch), which is the default. The *Functions | Increment/decrement master tuning by one percent of a semitone* options then allow the tuning to be raised or lowered, with a maximum adjustment of 99 percent of a semitone in either direction:



The tuning increment is displayed in the status bar at the bottom of the main window:

The menu functions can be triggered by MIDI, so you could include tuning +/- buttons on a MIDI console if you wished.

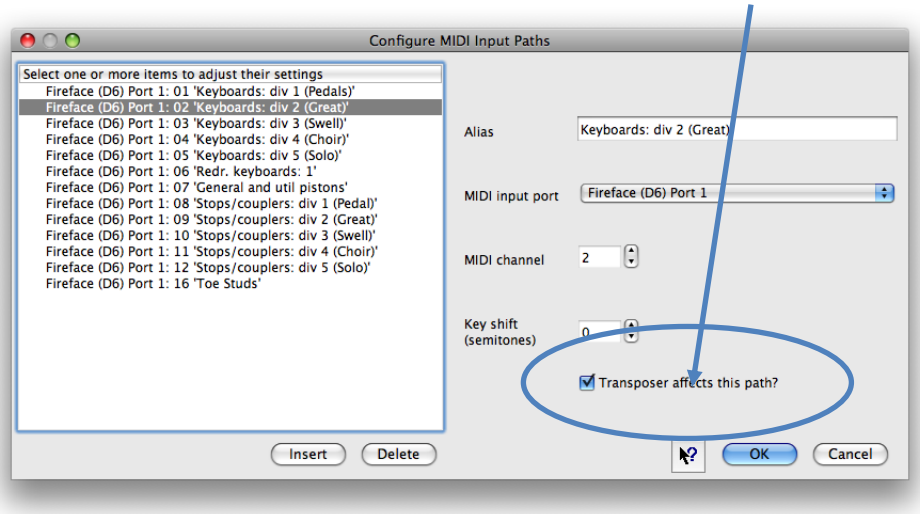
Note that the tuning menu functions are disabled, and the tuning cannot be adjusted, if the *Disable interpolation (use fixed-pitch playback)?* option is selected on either of the *General settings | General options* or *Organ settings | General options* screens, since interpolation is required in order that Hauptwerk can control the pitch of the pipes.

The transposer

Hauptwerk has a transposer, which adds to or subtracts from the note numbers of incoming MIDI messages. It thus enables you to hear pieces of music in keys other than that in which you play them, which may be useful if you wish to accompany singers but do not wish to transpose by sight, for example.

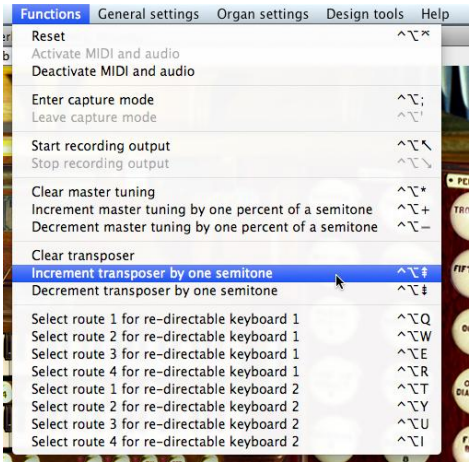
Note that the transposer only raises or lowers the pitch of what you play by whole note increments, and that the playback pitch of the virtual pipes is not altered in any way, since the increment is applied at the incoming MIDI note message level. Thus if you play a bottom C note with the transposer set to +1, Hauptwerk will actually make the bottom C# pipe sound. Bear this in mind, since it can mean that keys at the ends of the keyboard no longer sound pipes when the transposer is used. However, by incrementing the note number rather than adjusting the playback pitch of the pipes, the pipes continue to sound absolutely natural, and any real external pipework or voice modules being driven by Hauptwerk will automatically be affected equally.

The *Transposer affects this path?* setting on the *General settings | MIDI input paths* screen is used to prevent the transposer affecting MIDI input paths which are used for switch MIDI inputs:



Note that for this reason, you may prefer not to mix MIDI keys and MIDI control switches on a single MIDI encoder, where the setting would affect the whole MIDI channel.

The *Functions | Clear transposer* menu option turns off the transposer (the default). *Functions | Increment/Decrement transposer by one semitone* options adjust its setting relative to its current value, and can be triggered by MIDI if required:



The current increment applied by the transposer is shown in the status bar at the bottom of the main window:

MIDI Input

MIDI and computer keyboard input

Although you can operate virtual controls with the mouse once a sample set is loaded, Hauptwerk is primarily played and controlled by MIDI. Except for menu items that require a file selection or prompt, all menu items can also be triggered by MIDI. You can also set up short-cut keys on your computer keyboard to trigger virtual controls and menu items.

Once installed and configured, Hauptwerk can thus operate fully without a computer monitor, mouse or keyboard, allowing it to be integrated into a MIDI organ console or voice expander, and also allowing full control from a MIDI sequencer or other device.

The Advanced Edition of Hauptwerk can also produce MIDI output to control external MIDI organ console controls (such as solenoid-actuated draw-knobs), status lamps, real external pipework, voice expanders and LCD panels to label controls appropriately for the sample set loaded, all of which are covered in the MIDI output section.

This section will give an overview of the MIDI input configuration and the corresponding setting screens. We will not describe all of the individual settings on those screens here, since comprehensive documentation is available for each setting and screen by clicking on the pointer/question-mark icon immediately to the left of a screen's *OK* button:

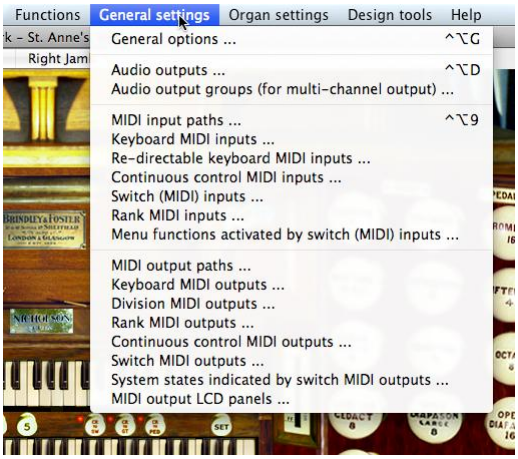
... then clicking onto the screen background or a specific setting for a detailed explanation of its function.

This section is mainly applicable for using Hauptwerk as stand-alone software. If you are using it with a sequencer (as a VST plug-in or otherwise), then, apart from adjusting the MIDI input port selections, the default configuration installed with Hauptwerk will usually be appropriate.

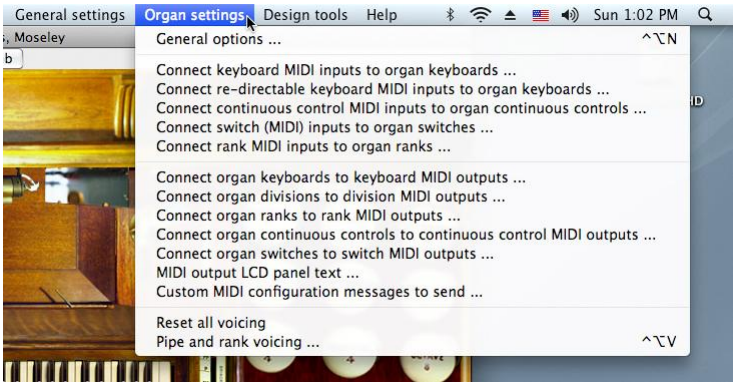
With all settings screens, the lists of objects are shown in the left-hand panes, and the current objects' details are shown on the right. Use the *Insert* and *Delete* buttons to create or delete objects. You cannot delete an object if other screens reference it; you must first go to the referencing screen(s) and delete all such referencing objects; see the settings screens section for more details.

Important: The set of objects installed initially with Hauptwerk are simply examples, so you can delete or adjust them to suit your MIDI hardware and software. If your MIDI configuration differs substantially from the defaults, you may prefer to delete all of the objects on the various input settings screens and then recreate them all from scratch.

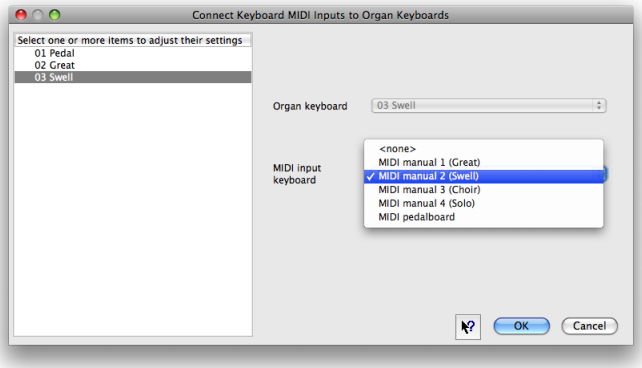
For stand-alone use, the *General settings* menu input screens describe the physical MIDI hardware that you have and wish to use with Hauptwerk:



The *Organ settings* menu input screens then describe how that physical hardware should be mapped to the virtual controls present in the sample set currently loaded. A different mapping can be stored for each sample set:



In almost all cases, the screens under the *Organ settings* menu show one object in the browse list for each equivalent virtual object in the sample set that you currently have loaded. In the right-hand pane you can then select the input object by which you wish it to be controlled, or 'none' if you do not wish it to be controlled remotely. As an example, look at the *Connect keyboard MIDI inputs to organ keyboards* screen:

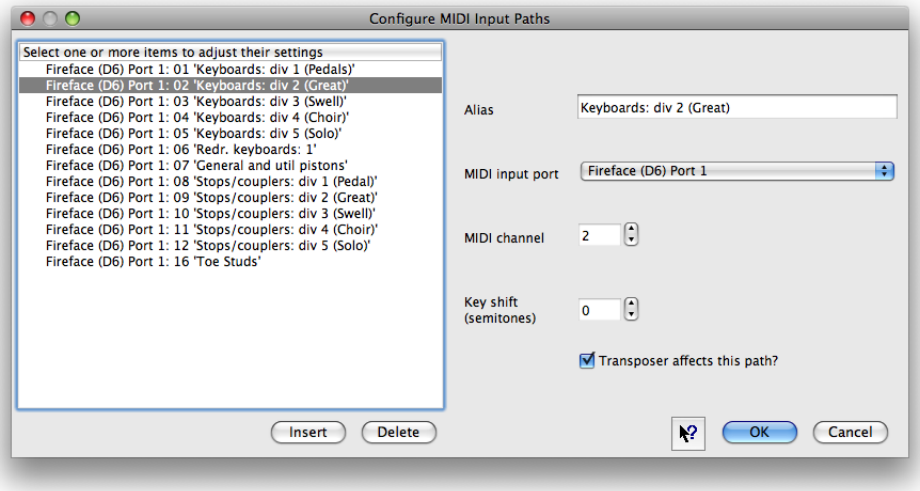


There is an entry in the left-hand browse pane for each virtual keyboard provided by the sample set loaded (St. Anne's, Moseley).

Important: It is essential to understand the distinction between the *General settings* and the *Organ settings* menus: the screens and their settings found under the *General settings* menu are mainly used to define your MIDI and audio hardware and apply to all sample sets. For example you would use the *General settings | Keyboard MIDI inputs* screen to list the MIDI keyboards you have attached to the computer. The default settings are just defaults; update or rename them to reflect your own hardware (or software) with which Hauptwerk will be used. The *Organ settings* menu instead stores settings that are specific to whichever sample set is currently loaded. Changing a setting on one of its screens only affects that sample set. The *Organ settings* menu is mainly used to map the virtual organ's controls to your hardware. For example, the *Organ settings | Connect keyboard MIDI inputs to organ keyboards* screen allows you to select which of your MIDI keyboards (that you defined on the *General settings | Keyboard MIDI inputs* screen) you want to map/connect to which of the virtual organ keyboards provided by the sample set. **Thus configuring Hauptwerk is a two-stage process: first list/configure your MIDI hardware via the *General settings* menu, then load each sample set and use the screens on the *Organ settings* menu to map your hardware to the corresponding virtual organ objects.**

MIDI input paths (MIDI ports and MIDI channels)

All of Hauptwerk's MIDI input is configured in terms of *MIDI input paths*, which are simply an abstraction of the combination of a computer MIDI input port and MIDI channel together, given a meaningful name. For each distinct combination of MIDI input port and MIDI channel that you wish to use to feed MIDI data to Hauptwerk you should create a single MIDI input path object using the *General settings | MIDI input paths* screen:



Ensure that you have one MIDI input path object for each distinct combination of MIDI input port and channel that your hardware or sequencer will use. There are no restrictions on which MIDI channels and ports can be used to control any of Hauptwerk's virtual controls. For example, if you have MIDI draw-knobs, you can arrange it so that each sends MIDI messages on any port and channel that is convenient.

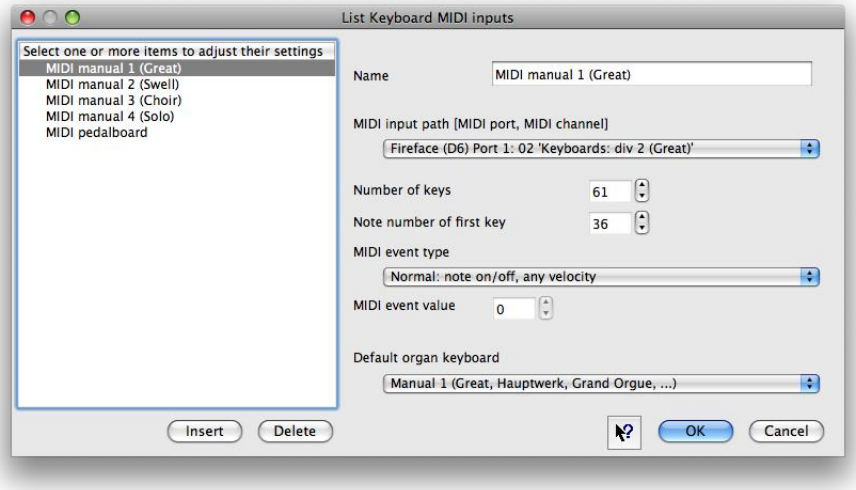
However, as explained in the section on the transposer section, note that the transposer is applied at the MIDI input path level, so you may prefer not to mix MIDI keyboards and switches on the same port/channel combination if you intend to use the transposer.

If it helps to clarify that MIDI input paths are nothing more than an abstraction of MIDI port and channel, assuming you are just using one MIDI input port, simply rename each input path entry according to the MIDI channel selected for it. For

example, since MIDI channel 2 is selected by default for the path whose default name is 'Keyboards: div 2 (Great)', change the name of that path from 'Keyboards: div 2 (Great)' to 'MIDI channel 2'. Repeat for each of the others. For consistency, you might then want to insert additional entries for the remainder of the 16 possible MIDI channels.

Keyboard MIDI inputs

Use the *General settings | Keyboard MIDI inputs* screen to list each MIDI keyboard from which you wish to play Hauptwerk:

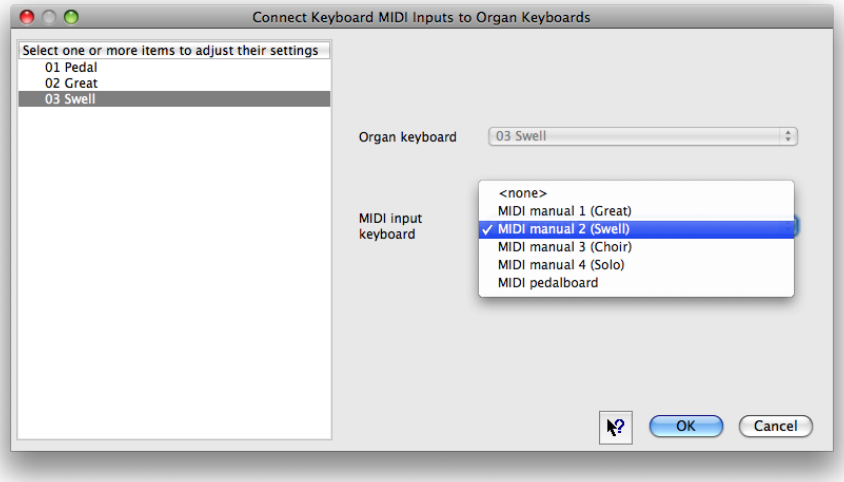


For example, if you have two MIDI keyboards and a MIDI pedalboard, then ensure that objects are listed for the three, and that the correct *Input path* is selected for the MIDI input port and MIDI channel used by each keyboard. Delete any objects that you will not be using.

The *MIDI event type/value* settings should always be set to 'Normal' unless you are configuring a 'second touch' theatre organ manual; see the question-mark help for more details.

It is important to set the *Default organ keyboard* setting appropriately, since it is used to define the initial mappings to a sample set's virtual keyboards whenever a sample set is loaded for the first time.

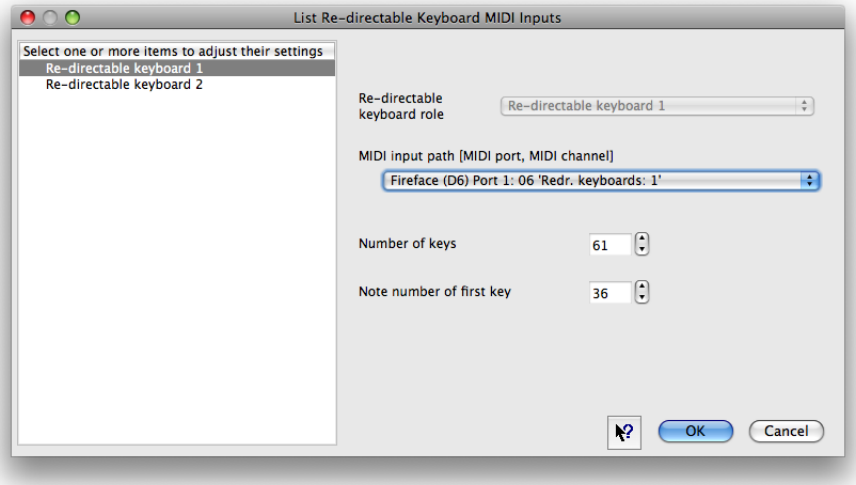
The *Organ settings | Connect keyboard MIDI inputs to organ keyboards* screen is used to adjust the mapping between input keyboards and virtual keyboards for a sample set if the default mapping (determined by the *Default organ keyboard* setting) is not appropriate:



Re-directable keyboard MIDI inputs

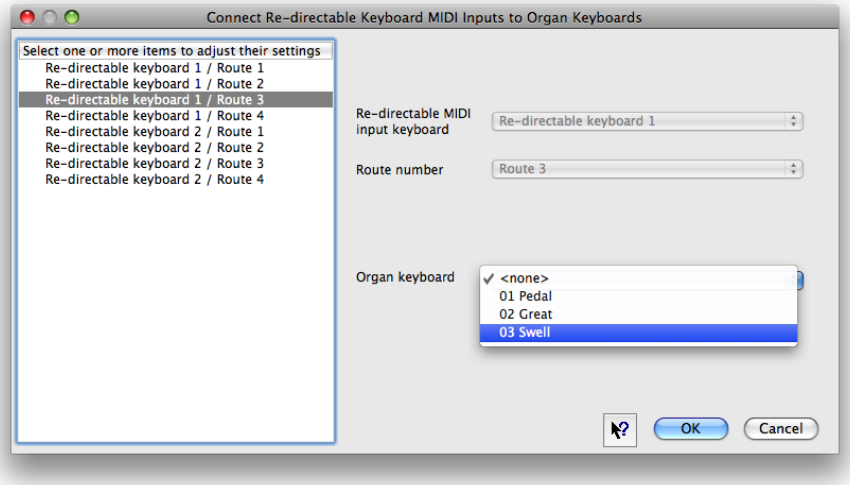
The re-directable inputs allow you to control more virtual keyboards than you have physical MIDI keyboards. You can connect at most two MIDI keyboards in this way, and flip them between virtual keyboards using the *Functions | Select route N for re-directable keyboard M* menu functions. Four possible 'routes' (virtual keyboards) are allowed from each re-directable keyboard. See the re-directable inputs section for further details.

Use the *General settings | Re-directable keyboard MIDI inputs* screen to define which, if any, MIDI keyboards you have which you would like to use in this way:



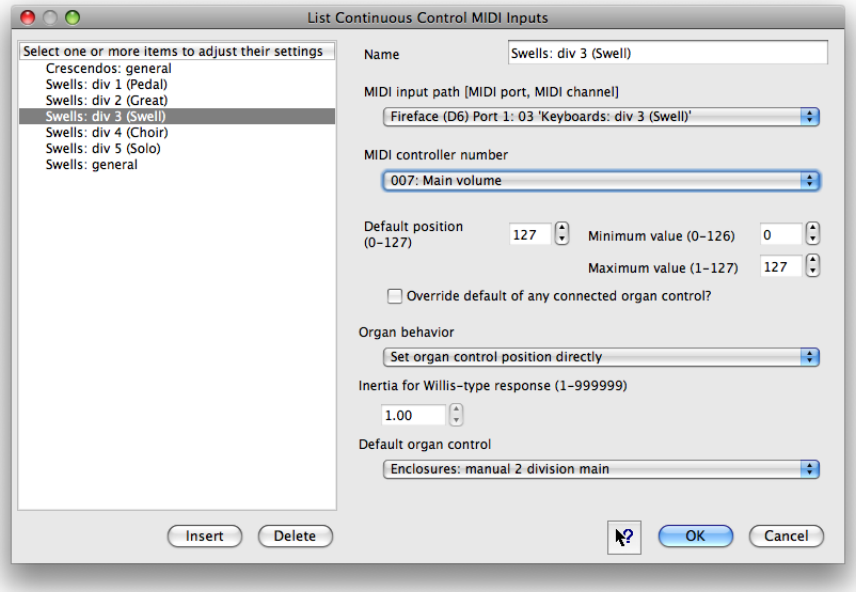
If you do not wish to use any MIDI keyboards as re-directable inputs, simply set the *Input path* to 'none' for both objects.

The *Organ settings | Connect re-directable keyboard MIDI inputs to organ keyboards* screen is used to define how each of the four routes for each of the two re-directable keyboards are to be connected to virtual keyboards, and thus which virtual keyboards can be controlled from each of the two possible re-directable keyboards:



Continuous control MIDI inputs (swell pedals, crescendo pedals, etc.)

Use the *General settings | Continuous control MIDI inputs* screen to list all MIDI continuous controllers you have and with which you wish to control Hauptwerk's virtual continuous controls:



See the virtual console section for an explanation of Hauptwerk's virtual continuous controls. Most commonly they are used to represent swell and crescendo pedals. The most common type of MIDI continuous controllers used with Hauptwerk are MIDI expression pedals.

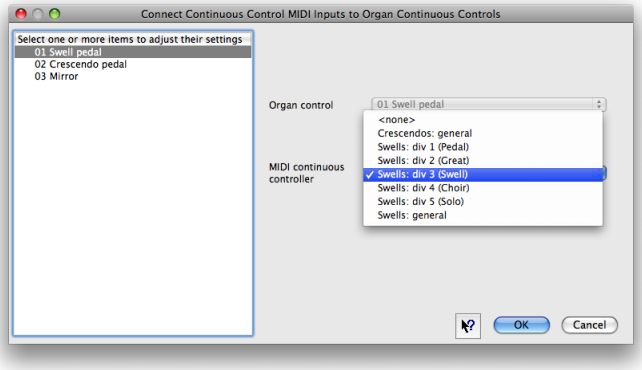
Set the *Controller number* to match the MIDI continuous controller number sent by the MIDI device. The most common controller numbers are:

- 1 - Modulation wheel.
- 4 - Foot controller.
- 6 - Data entry control.
- 7 - Main volume.
- 11- Expression.

Again, you should ensure that the *Default organ control* is specified when possible, so that the MIDI controller is automatically mapped to the sample set's appropriate virtual continuous control when a sample set is loaded for the first time.

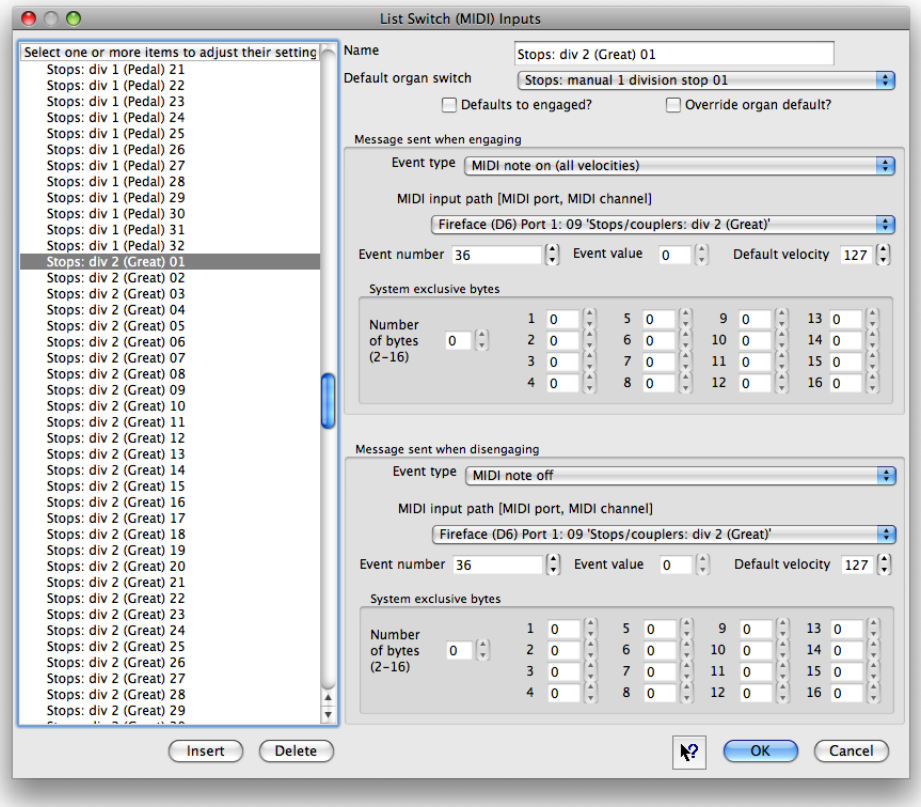
Some electronic organ consoles have expression pedals that do not cover the full 0-127 range of MIDI controller values. You can use the *Minimum value* and *Maximum value* settings to stretch the ranges of such controls to cover the full range.

The *Organ settings | Connect continuous control MIDI inputs to organ continuous controls* screen is used to adjust the mapping between input continuous controls and virtual continuous controls for a sample set if the default mapping (determined by the *Default organ control* setting) is not appropriate:



Switch (MIDI) inputs (stops, couplers, tremulants, pistons, etc.)

Use the *General settings | Switch (MIDI) inputs* screen to list all MIDI buttons/switches and computer keys that you have and with which you wish to control Hauptwerk's virtual switch controls (such as virtual draw-knobs and pistons) and to delete any objects that are not relevant for your hardware:



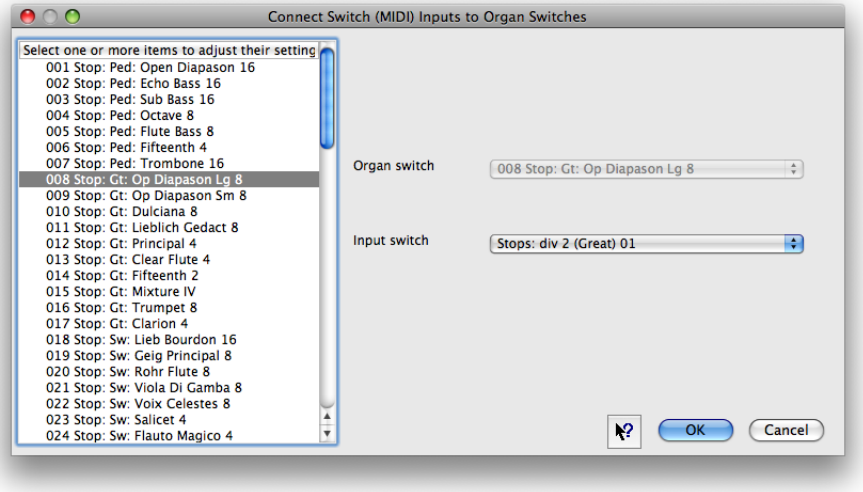
You need to specify the message that your hardware switch sends when it is engaged (the 'engaging event') and when it is disengaged (the 'disengaging event'). Any message type and MIDI input path can be used for either, with no restrictions. *(*)*

Note that for MIDI note-on/off messages the *Event number* setting specifies the MIDI note number, with numbering starting from zero. For MIDI program change messages it specifies the program number, with numbering starting from one.

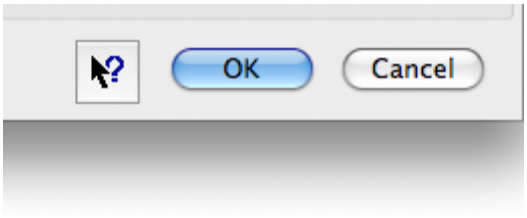
If your MIDI switch (or computer key) sends a message only as you press it down, and not when it is released, as is usual for push-buttons/pistons, then set the disengaging event type to 'none', so that Hauptwerk will keep its logical representation of the switch synchronized with the state of the physical switch.

As with keyboard MIDI inputs and continuous control MIDI inputs, it is important to specify the *Default organ switch* setting when possible, since it greatly simplifies configuration of each new sample set loaded.

The *Organ settings | Connect switch (MIDI) inputs to organ switches* screen is used to adjust the mapping between input switches and virtual switches for a sample set if the default mapping (determined by the *Default organ switch* setting) is not appropriate:



See also the question-mark help for the *Effect when engaged/disengaged* settings:

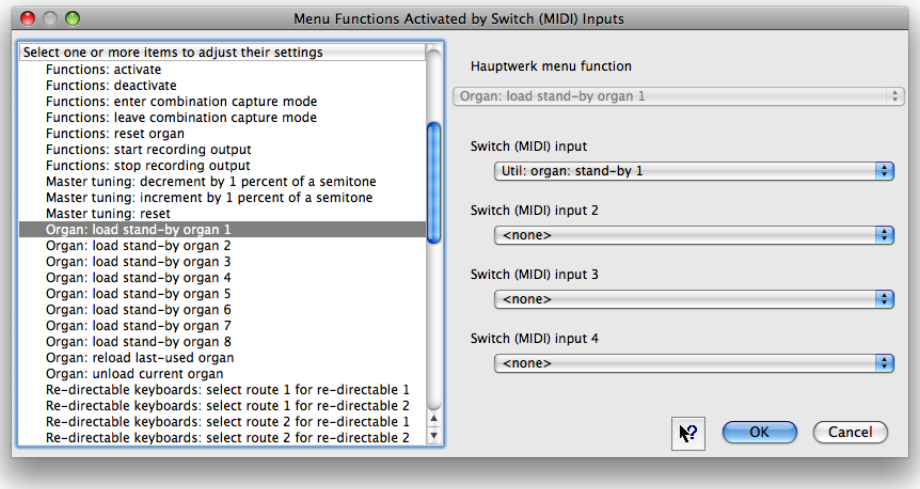


See the MIDI implementation section in the appendix of this manual for the list of computer key codes.

(*) Note that engaging and disengaging MIDI messages cannot be identical for a given MIDI switch unless you want Hauptwerk to toggle/pulse the state of any connected organ switch in response to such a message, in which case please simply select 'None (engaging event toggles/pulses)' for the disengaging event type setting.

Menu functions activated by switch (MIDI) inputs

Use the *General settings | Menu functions activated by switch (MIDI) inputs* screen to connect your MIDI switches or computer keys to Hauptwerk's menu functions, so that they can be triggered remotely:

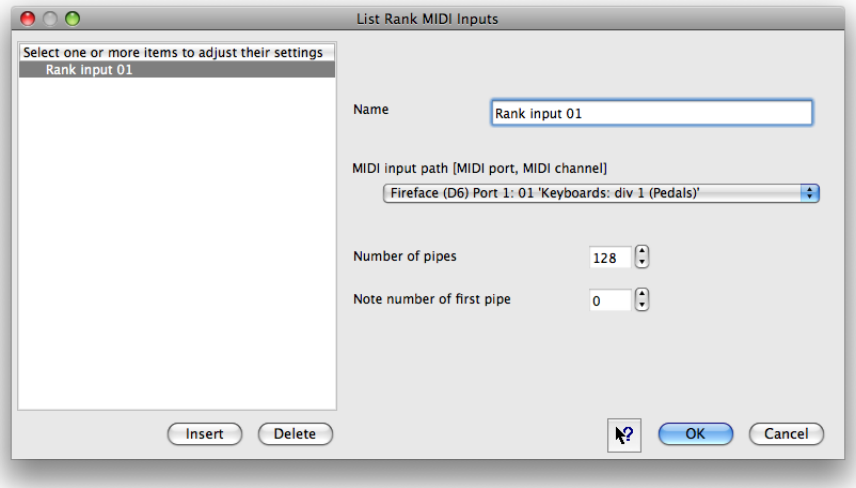


You cannot insert or delete objects in this screen, since the object list always shows the list of all menu functions that allow remote triggering. For each menu function, either select the switch (MIDI) input that you wish to use, or select 'none' if you do not wish to control it remotely. Note that you can select up to four switch (MIDI) inputs to trigger any given menu function. This might be useful, for example, for registration sequencer controls, where you might want a toe piston and a thumb piston both to be able to trigger the 'next frame' function.

The menu function is always triggered as the switch input is *engaged*, and never when it is disengaged.

Rank MIDI inputs

The *General settings | Rank MIDI inputs* screen allows you to feed MIDI input directly into Hauptwerk's virtual pipe ranks, bypassing its virtual keyboards, key actions, couplers and so forth. It thus allows you to use Hauptwerk like a simple multi-timbral voice expander, with each rank responding directly on a separate MIDI channel:



There is no default mapping setting for the ranks, so you must map them manually with *Organ settings | Connect rank MIDI inputs to organ ranks*.

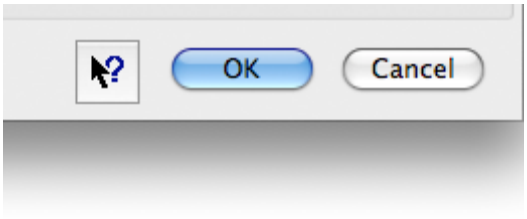
MIDI output

As well as being controlled by MIDI (see the MIDI input section), the Advanced Edition of Hauptwerk can also produce MIDI output (no MIDI output facilities are available in the Hauptwerk Basic Edition). This enables it to:

1. Control solenoid-actuated/illuminated MIDI draw-knobs/tabs on a MIDI organ console.
2. Control status indicator lamps to show its status.
3. Control LCD panels to show labels for the controls on a MIDI organ console, appropriate to each sample set loaded, and also to control a status display LCD panel.
4. Control ranks of real external pipework in addition to its internal digital voices.
5. Likewise control external voice expanders.

Although functions 1 to 3 can be performed for all sample sets, subject to the appropriate MIDI hardware being available, functions 4 and 5 require specific custom organ definition files, in order that Hauptwerk knows how the external ranks or voices should be incorporated into the virtual organ. This is normally achieved using the *Custom Organ Design Module*, which is the subject of a separate manual that can be found on the *Help* menu, and is discussed briefly in the design tools section.

This section will give an overview of the MIDI output configuration and the corresponding setting screens. We will not describe all of the individual settings on those screens here, since comprehensive documentation is available for each setting and screen by clicking on the pointer/question-mark icon immediately to the left of a screen's *OK* button:



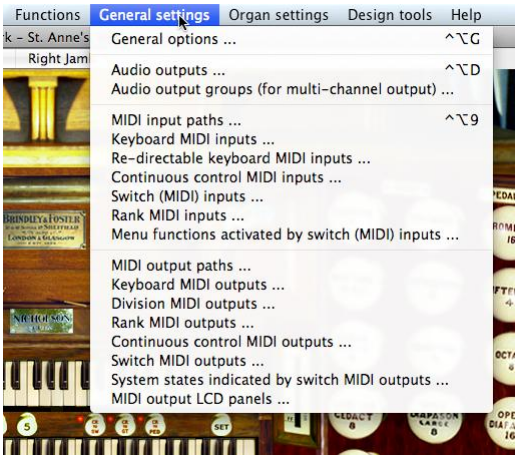
... then clicking onto the screen background or a specific setting for a detailed explanation of its function.

This section is mainly applicable for using Hauptwerk as stand-alone software. If you are using it with a sequencer (as a VST plug-in or otherwise), then you would not normally need to use Hauptwerk's MIDI output capabilities.

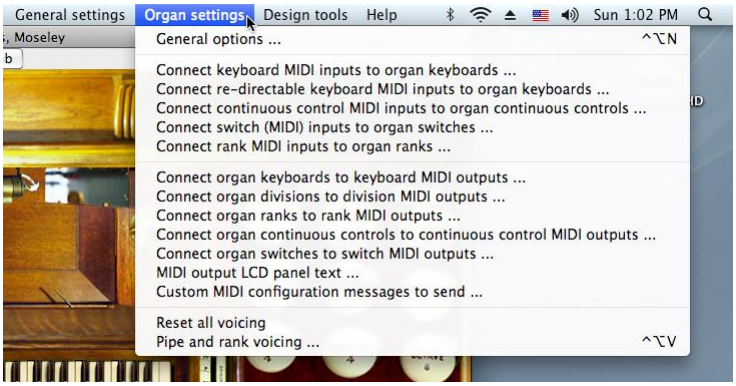
With all settings screens, the lists of objects are shown in the left-hand panes, and the current objects' details are shown on the right. Use the *Insert* and *Delete* buttons to create or delete objects. You cannot delete an object if other screens reference it; you must first go to the referencing screen(s) and delete all such referencing objects; see the settings screens section for more details.

Important: The set of objects installed initially with Hauptwerk are simply examples, so you can delete or adjust them to suit your MIDI hardware and software. If your MIDI configuration differs substantially from the defaults, you may prefer to delete all of the objects on the various MIDI output settings screens and then recreate them all from scratch.

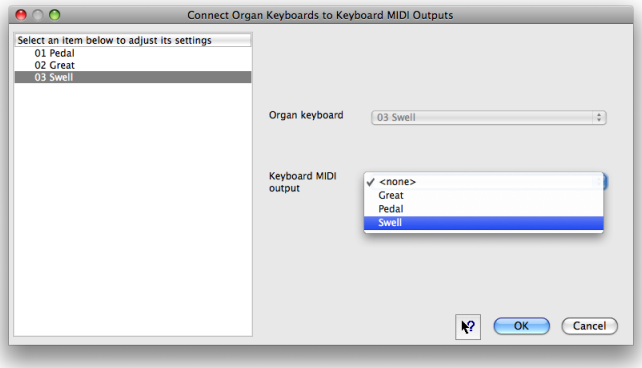
For stand-alone use, the *General settings* menu output screens describe the physical MIDI hardware that you have and wish to use with Hauptwerk:



The *Organ settings* menu output screens then describe how that physical hardware should be mapped to the sample set currently loaded. A different mapping can be stored for each sample set:



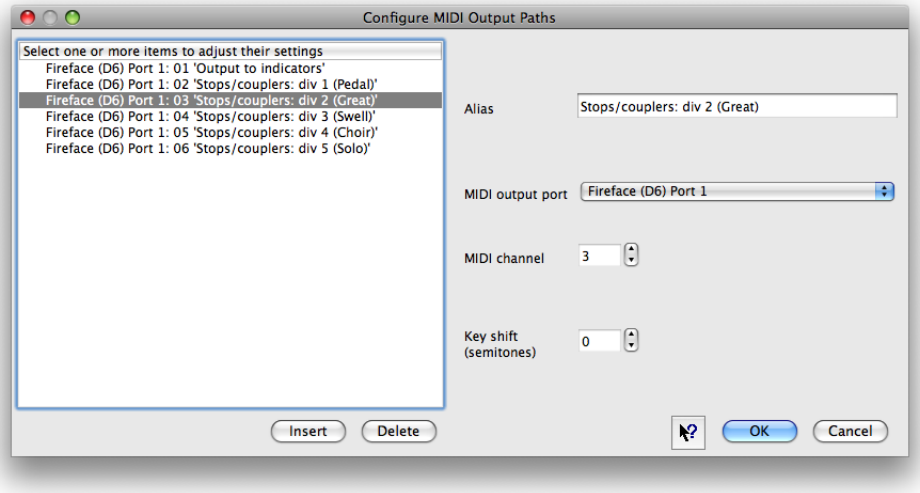
In most cases, the screens under the *Organ settings* menu show one object in the browse list for each equivalent virtual object in the sample set that you currently have loaded. In the right-hand pane you can then select the output object you wish to control from it, or 'none' if you do not wish the sample set's virtual control to produce MIDI output. As an example, look at the *Connect organ keyboards to keyboard MIDI outputs* screen:



There is an entry in the left-hand browse pane for each virtual keyboard provided by the sample set loaded (St. Anne's, Moseley).

MIDI output paths (MIDI ports and MIDI channels)

All of Hauptwerk's MIDI output is configured in terms of *MIDI output paths*, which are simply an abstraction of the combination of a computer MIDI output port and MIDI channel together, given a meaningful name. For each distinct combination of MIDI output port and MIDI channel to which you wish Hauptwerk to send MIDI you should create a single MIDI output path object using the *General settings | MIDI output paths* screen:

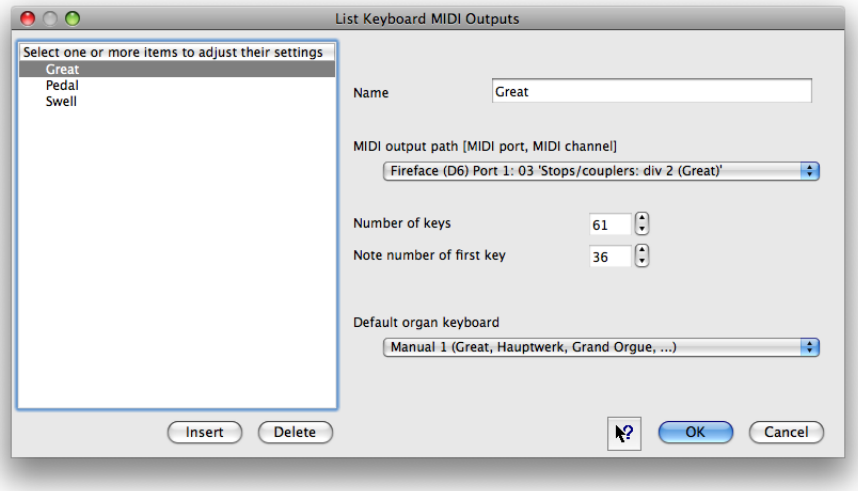


Ensure that you have one MIDI output path object for each distinct combination of MIDI output port and channel to which you wish Hauptwerk to send MIDI. There are no restrictions on which MIDI channels and ports can be used for output from any of Hauptwerk's virtual controls. For example, if you have MIDI solenoid-actuated draw-knobs, you can arrange it so that Hauptwerk sends MIDI messages to each on any port and channel that is convenient.

If it helps to clarify that MIDI output paths are nothing more than an abstraction of MIDI port and channel, simply blank out the *Alias* setting on the right-hand pane for the first entry in the left-hand pane browse list, so that only the MIDI port and channel are shown for it in the browse list. Repeat for each of the other entries in the left-hand browse list. For consistency, you might then want to insert additional entries for the remainder of the 16 possible MIDI channels.

Keyboard MIDI outputs

Use the *General settings | Keyboard MIDI outputs* screen to define logical outputs to which MIDI can be routed directly from the virtual keyboards of Hauptwerk's sample sets:



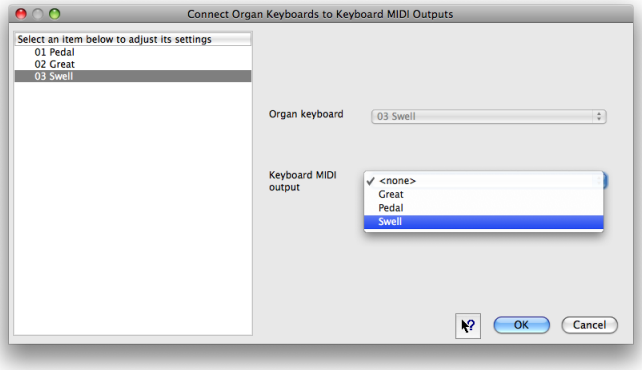
Note that there is a subtle difference here with the input system: for keyboard MIDI inputs you define the hardware that you have (MIDI keyboards) so that Hauptwerk can interpret messages from it correctly. However, a keyboard MIDI *output* does not necessarily represent a real, physical MIDI keyboard. It is simply a logical 'route' or 'destination' to which output can be sent from one of a sample set's virtual keyboards. It might, for example, be used to send MIDI to an external voice expander.

Key action couplers will not affect any MIDI output sent in this way, i.e. the outputs will be *pre-coupling*. See the screen's question-mark help for more details.

There are no keyboard MIDI outputs defined by default, so you must insert them yourself if you want to send MIDI output from the virtual keyboards. The entries in the screenshot above are just examples.

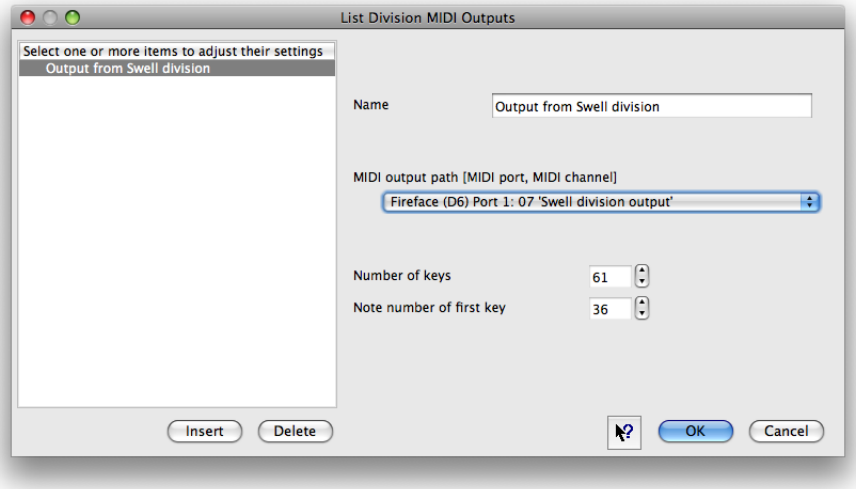
It is useful to set the *Default organ keyboard* setting appropriately, since it is used to define the initial mappings to a sample set's virtual keyboards whenever a sample set is loaded for the first time.

The *Organ settings | Connect organ keyboards to keyboard MIDI outputs* screen is used to adjust the mapping between virtual keyboards and keyboard outputs for a sample set if the default mapping (determined by the *Default organ keyboard* setting) is not appropriate:



Division MIDI outputs

Use the *General settings | Division MIDI outputs* screen to define logical outputs to which MIDI can be routed directly from the virtual divisions (wind-chests) of Hauptwerk's sample sets:



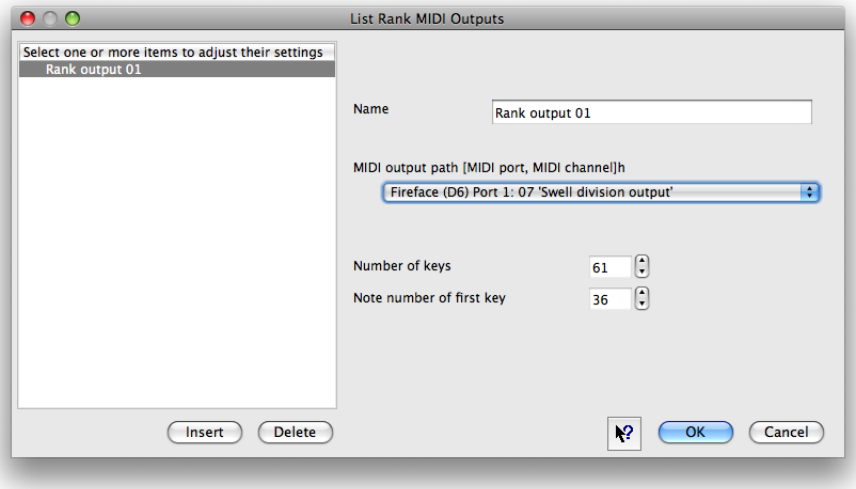
Essentially, division outputs behave in the same way as keyboard outputs, except that output is sent *post-coupling*. Hence in many cases these outputs, rather than keyboard MIDI outputs, will be the most appropriate means by which to connect MIDI wind-chests and voice expanders. See the screen's question-mark help for more details.

There are no division MIDI outputs defined by default, so you must insert them yourself if you want to send MIDI output from the virtual divisions. The entries in the screenshot above are just examples.

There is also no default mapping mechanism for divisions; you must map divisions manually using the *Organ settings | Connect organ divisions to division MIDI outputs* screen when a sample set is loaded.

Rank MIDI outputs

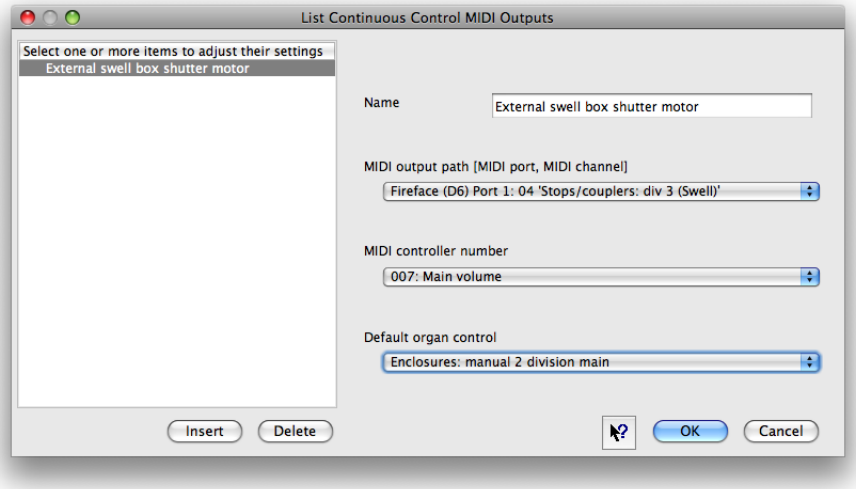
Use the *General settings | Rank MIDI outputs* screen to define logical outputs to which MIDI can be routed directly from the individual virtual ranks of Hauptwerk's sample sets:



When mapped to an organ rank with *Organ settings | Connect organ ranks to rank MIDI outputs* (there is no default mapping), individual MIDI note-on/off messages are sent for each virtual pipe, which may give a high volume of MIDI traffic. See the screen's question-mark help for more details.

Continuous control MIDI outputs (swell pedals, crescendo pedals, etc.)

Use the *General settings | Continuous control MIDI outputs* screen to define logical outputs to which MIDI can be routed directly from the individual virtual continuous controls of Hauptwerk's sample sets:



Set the *Controller number* for the MIDI continuous controller that Hauptwerk should send. The most common controller numbers are:

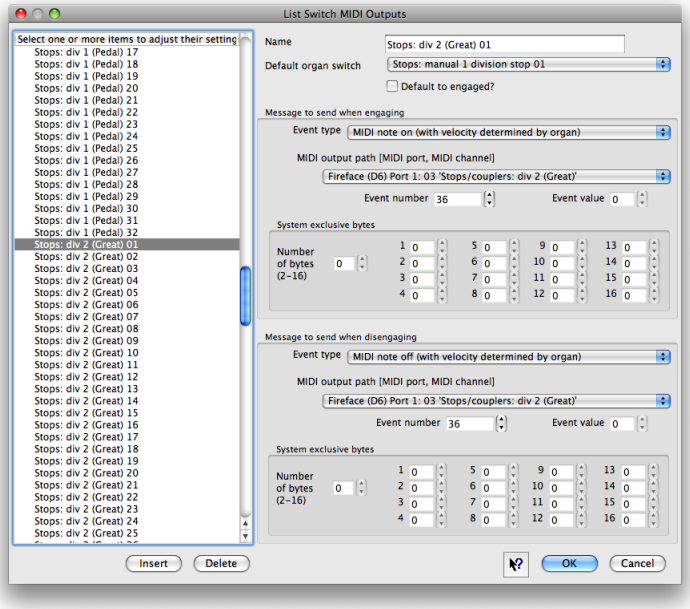
- 1 - Modulation wheel.
- 4 - Foot controller.
- 6 - Data entry control.
- 7 - Main volume.
- 11- Expression.

It is important to set the *Default organ control* setting appropriately, since it is used to define the initial mappings to a sample set's virtual continuous controls whenever a sample set is loaded for the first time.

The *Organ settings | Connect organ continuous controls to continuous control MIDI outputs* screen is used to adjust the mapping between virtual continuous controls and continuous control outputs for a sample set if the default mapping (determined by the *Default organ control* setting) is not appropriate.

Switch MIDI outputs (stops, couplers, tremulants, pistons, etc.)

Use the *General settings | Switch MIDI outputs* screen to define logical outputs to which MIDI can be routed directly from the individual virtual switch controls of Hauptwerk's sample sets, such as virtual draw-knobs and pistons:

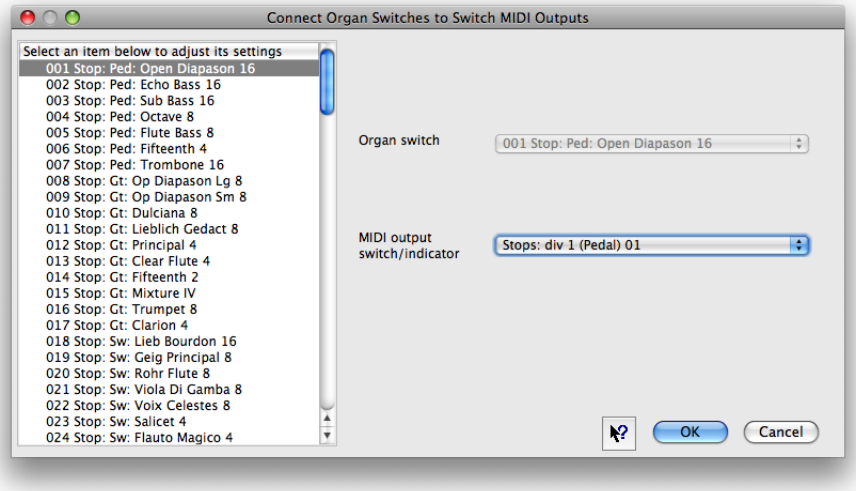


You need to specify the message that should be sent when the virtual switch is engaged (the 'engaging event') and when it is disengaged (the 'disengaging event'). Any message type and MIDI output path can be used for either, with no restrictions.

Note that for MIDI note-on/off messages the *Event value* setting specifies the MIDI note number, with numbering starting from zero. For MIDI program change messages it specifies the program number, with numbering starting from one.

As with the other output screens, it is important to specify the *Default organ switch* setting when possible, since it greatly simplifies configuration of each new sample set loaded.

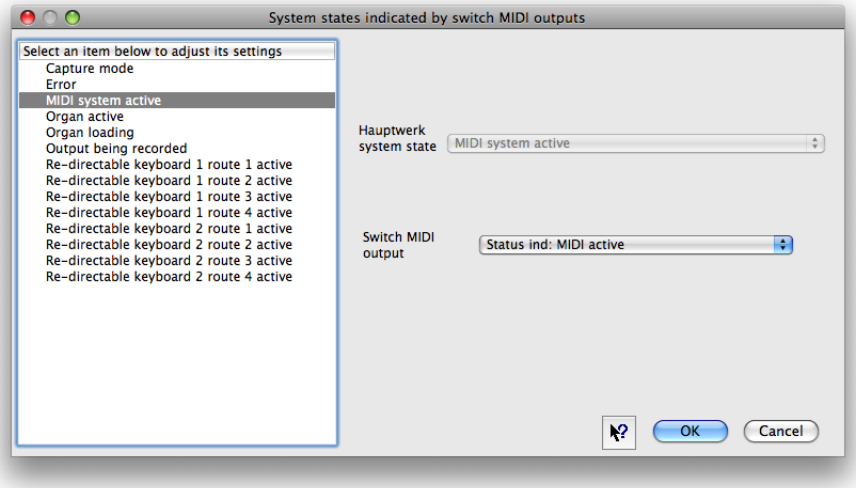
The *Organ settings | Connect organ switches to switch MIDI outputs* screen is used to adjust the mapping between virtual switches and output switches for a sample set if the default mapping (determined by the *Default organ switch* setting) is not appropriate:



Note that switch MIDI outputs can also be used as indicators for Hauptwerk's status, as described for *System states indicated by switch MIDI outputs* below.

System states indicated by switch MIDI outputs

Use the *General settings | System states indicated by switch MIDI outputs* screen to make Hauptwerk use external MIDI switches (usually indicator lamps) to show its system statuses:



You cannot insert or delete objects in this screen, since the object list always shows the list of all system states that can be sent to remote indicators. For each system state, either select the switch MIDI output that should be controlled by Hauptwerk to indicate the state, or select 'none' if you do not wish to indicate it remotely.

MIDI output LCD panels

Hauptwerk is able to control 32-character LCD panels to show labels specific to the sample set loaded. Usually this would be used to show stop, coupler, piston and other control names next to MIDI draw-knobs/tabs on an organ console so that their function is clear when multiple sample sets are used. However, one LCD panel can also be designated as a status display panel (using the *General settings | General options* screen), upon which Hauptwerk will display a summary of the information shown in its main window title and status bar, along with an indication of whether an error has occurred.

The messages are sent using a custom MIDI system exclusive message format each time that at a sample is loaded, unloaded or reset. The exception is the status panel, if present, which is refreshed each time a status changes.

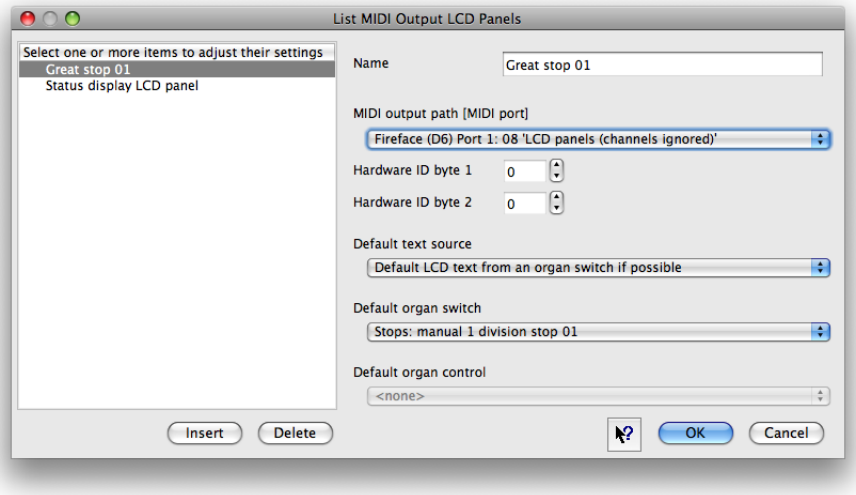
Each hardware LCD panel should be programmed with a 2-byte identifier which identifies it uniquely. Up to 32 characters can be sent to each display, with the text data being sent as raw ASCII (8-bit) byte sequences. A color code is also sent to each panel so that it can be back-lit or otherwise associated with a color to indicate its broad function (stop, coupler, etc.) or grouping (division, etc.).

The format of the system exclusive messages (for hardware developers) is:

- Byte 1: 0xf0 - system exclusive start.
- Byte 2: 0x7d - fixed manufacturer ID.
- Byte 3: 0x01 - message type code for Hauptwerk LCD output message.
- Byte 4: - destination panel unique ID byte 1.
- Byte 5: - destination panel unique ID byte 2.
- Byte 6: - color code (1=white, 2=red, 3=green, 4=yellow).
- Bytes 7-38: the 32 ASCII (8-bit) bytes for the text to display.
- Byte 39: 0xf7 - end of system exclusive message.

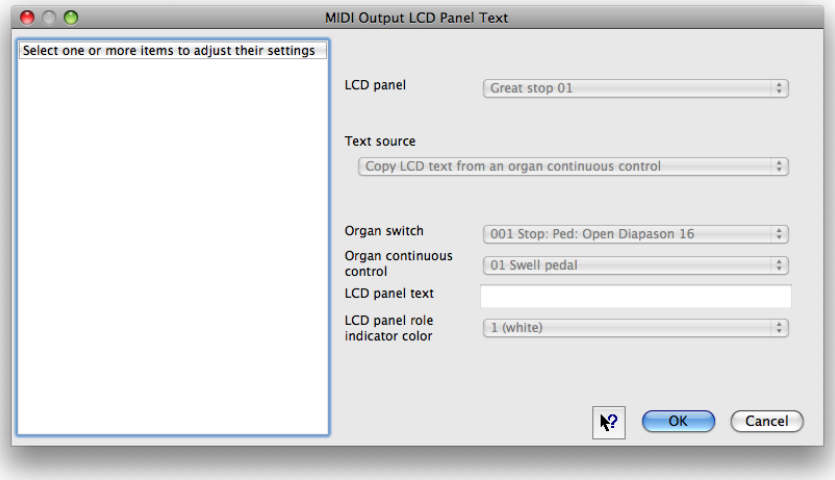
Note that no MIDI channel is sent, so, although a MIDI output path must be selected, it is only its MIDI port that affects the routing (its MIDI channel setting is ignored).

The *General settings | MIDI output LCD panels* screen is used to list all such LCD panels that you have connected to the computer:



The *Default text source*, *Default organ switch* and *Default organ control* settings are used to determine the text that will be sent to the panel for a given sample set when it is first loaded. Suggested LCD panel text and a color code is specified in the sample sets for virtual switches and continuous controls, so by selecting a default switch or continuous control, Hauptwerk is able to use its text and color information as a default for the LCD panel when a sample set is first loaded.

When a sample set is loaded, the *Organ settings | MIDI output LCD panel text* menu function allows the defaults to be overridden:

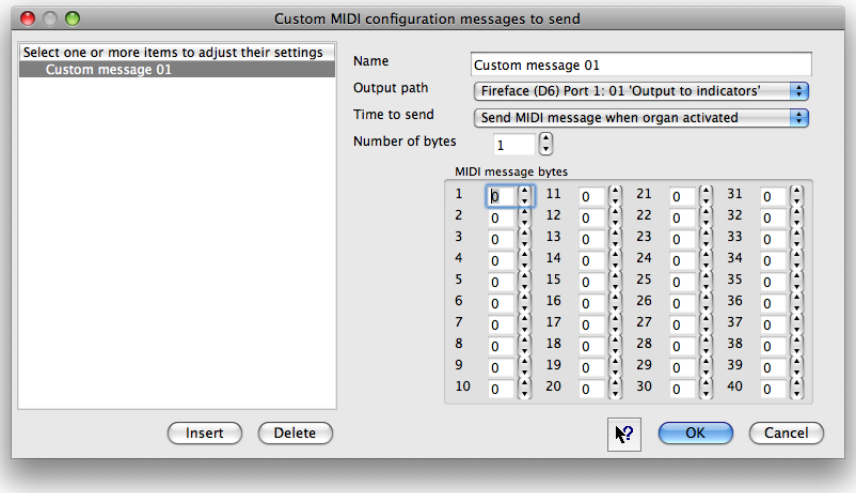


You can specify the text and color code manually for each panel if you wish, or change the source from which it is drawn.

Note that no configuration is included for LCD panels by default to reduce MIDI traffic during activation and deactivation. However, a full example set is available; please contact Milan Digital Audio if you require it.

Custom MIDI configuration messages

If you have an external MIDI organ console or expander which requires some custom MIDI configuration messages for each sample set, you can use the *Organ settings | Custom MIDI configuration messages to send* screen when a sample set is loaded:

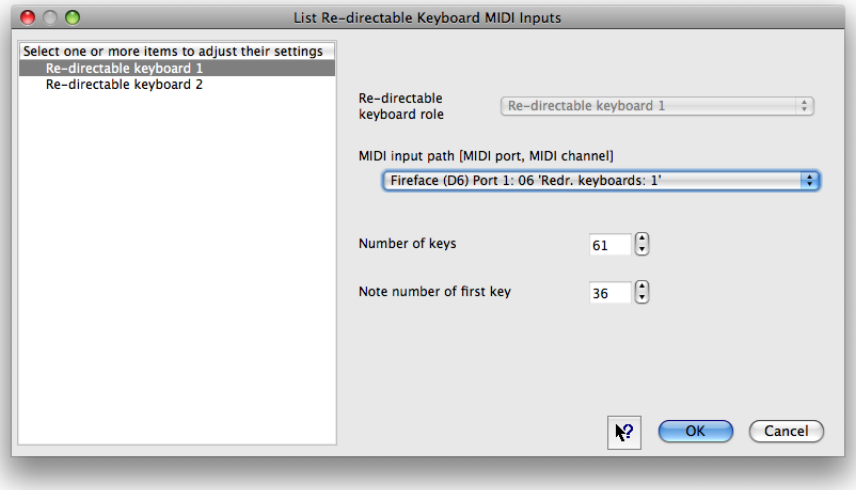


A message can be sent either when the sample set is activated or deactivated, and the exact number and sequence of raw MIDI bytes must be specified. Consult your hardware manual for this information if you need to use such messages.

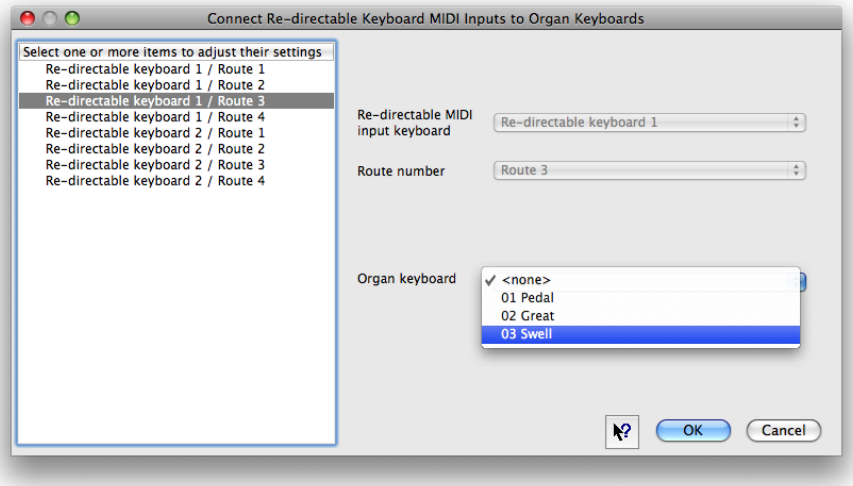
Re-directable inputs

As covered in the MIDI input section, you can designate up to two MIDI keyboards to control multiple virtual keyboards, then being able to flip each of the two MIDI keyboards between the designated virtual keyboards. You can thus play sample sets with more virtual keyboards than you have MIDI keyboards.

The *General settings | Re-directable keyboard MIDI inputs* screen is used to define the MIDI keyboards:

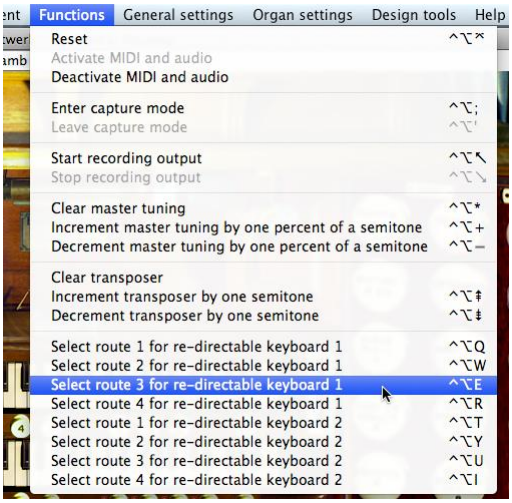


When a sample set is loaded the *Organ settings | Connect re-directable keyboard MIDI inputs to organ keyboards* screen is used to define which virtual keyboards are to be available as destinations for each of the MIDI keyboards:



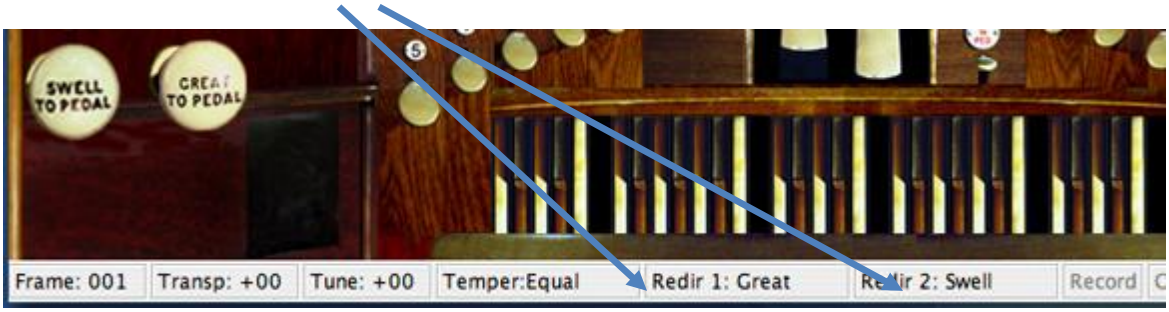
Up to four possible routes can be defined for each of the two possible re-directable keyboards. Although you cannot insert or delete objects in the screen, you can simply leave the *Organ keyboard* set to 'none' for a route if you do not wish to use it.

When Hauptwerk is active, you can then flip the MIDI keyboard(s) between the available routes using the *Functions | Select route N for re-directable keyboard M* menu options:



The menu options can also be triggered by MIDI, so you could assign them to external MIDI program change buttons, for example. See the menus section for details.

The current selections for the two possible re-directable inputs are shown in the status bar at the bottom of the main window:



The component installer

Hauptwerk includes a native installer which is used to install Hauptwerk sample sets, organs, temperaments and other components that are available separately from Hauptwerk itself and from third parties. The installer also has the ability to upgrade components, apply patches, and un-install components, while ensuring that all components are automatically installed into the correct locations on all supported operating systems and platforms, and ensuring that dependencies are satisfied.

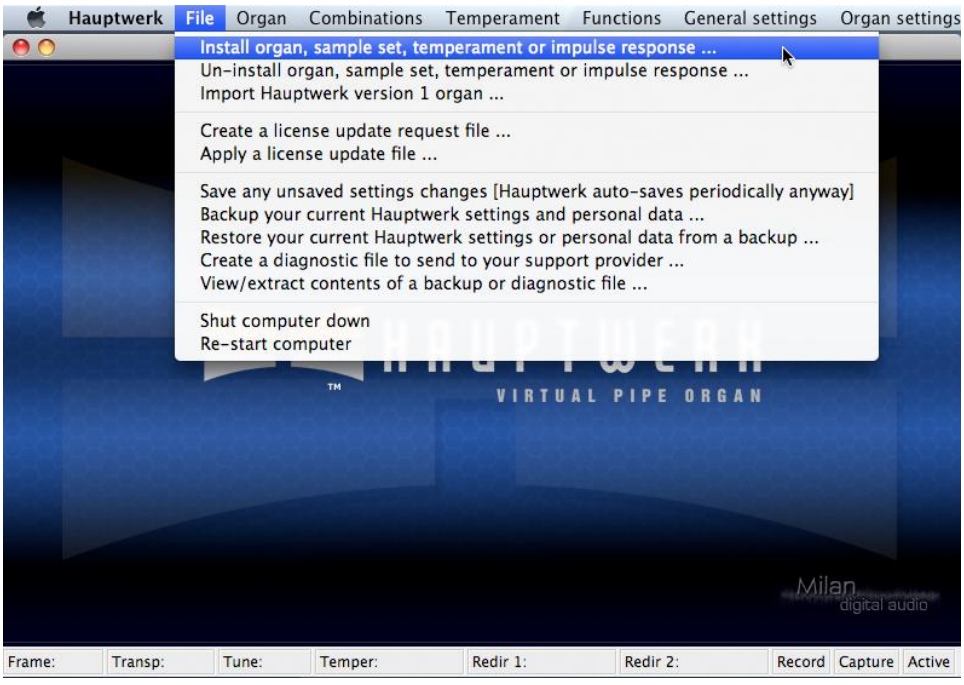
You should always use the component installer when you wish to install, upgrade or remove any Hauptwerk components provided in Hauptwerk version 2 format or above. *(Hauptwerk version 1 sample sets must instead be imported, which is covered in the importing version 1 organs section.)*

Installing a new component

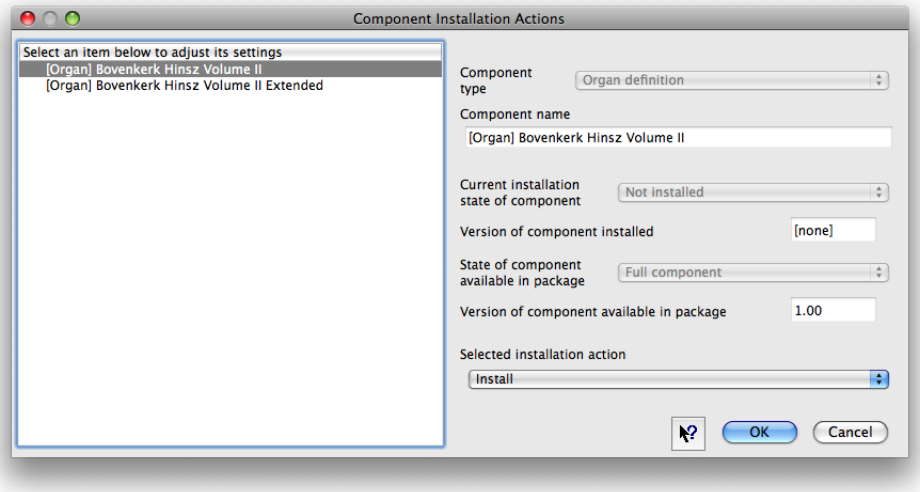
Components (such as additional sample sets) are supplied in Hauptwerk *component packages*, which are files with a filename extension *.CompPkg.Hauptwerk.rar*. A package may include several components of different types. We assume that you have downloaded such a component package, or that it has been supplied to you on CD or DVD.

Important: Please always use Hauptwerk's native component installer to install such packages, rather than attempting to extract or install them manually using third-party RAR extraction software. Using Hauptwerk's component installer will ensure that they are installed properly.

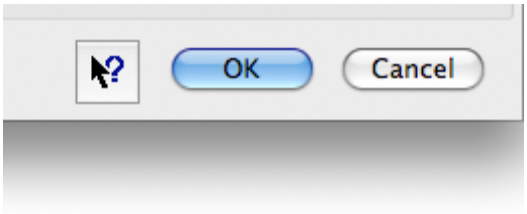
To install the new component, select *File | Install organ, sample set, temperament or impulse response* (note that impulse responses are not yet supported in the current version of Hauptwerk):



Navigate to the component package and select it. After a pause, the package should be extracted and analyzed by Hauptwerk's component installer, and the following screen should appear:



One item will be listed in the left-hand browse list for each component available in the package, and the right-hand pane will show its version, whether it is already installed, and the version installed if so. As with Hauptwerk's setting screens, click on the pointer/question-mark icon immediately to the left of a screen's *OK* button:

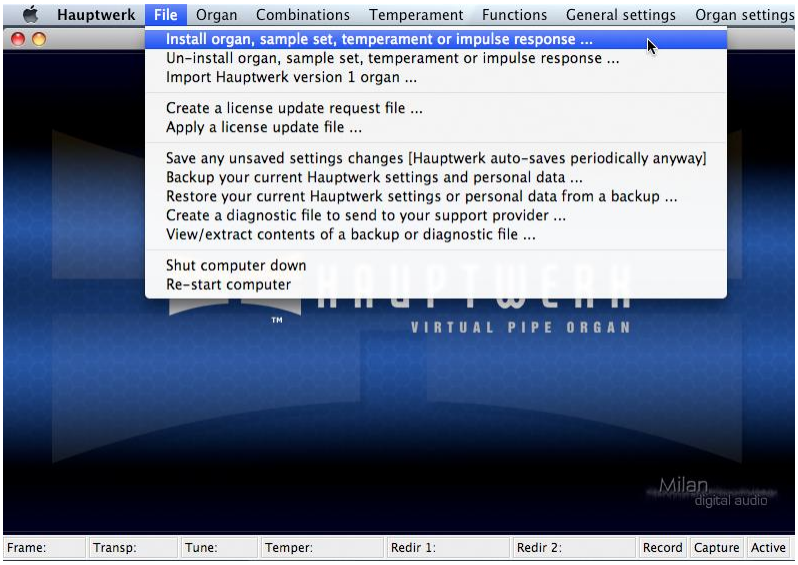


... then click onto the screen background or a specific setting for a detailed explanation of its function.

For each item in the component list, verify or adjust the *Selected installation action* in the right-hand pane (the default action is always to install, upgrade or re-install a component if possible), then click *OK*. The component(s) should then be installed and be ready to use. If you have been supplied with several packages, for example to install a large sample set which spans several CDs, repeat the process to install each of them.

Upgrading or patching a component

The process is identical for upgrading/patching: select *File | Install organ, sample set, temperament or impulse response*:

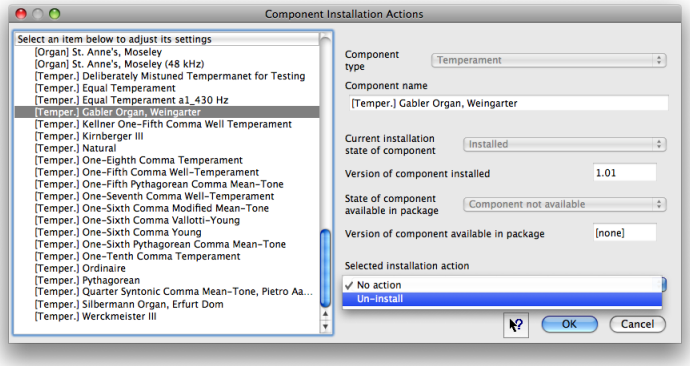


Now navigate to the new package, it will be opened and a list of its components displayed. Where upgrading or patching is possible, the *Selected installation action* will include an option for it, which will be selected by default. Simply check the selected actions and then click *OK* to perform them.

Un-installing a component

To remove a component, again ensure that no sample set is loaded (*Organ | Unload organ* if necessary), then select *File | Un-install organ, sample set, temperament or impulse response* from the menu.

After a brief pause the component installer screen will show a list of all components currently installed:

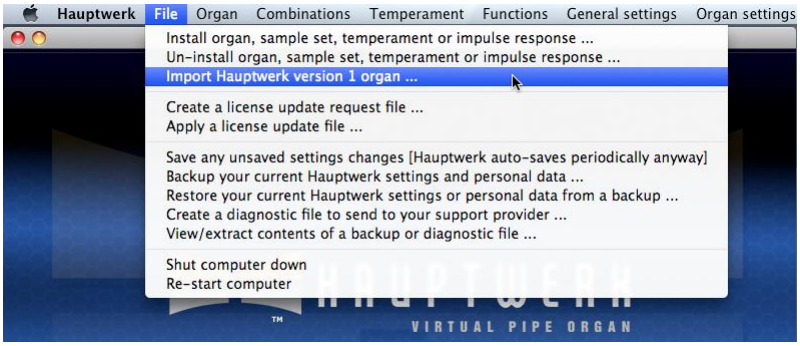


Simply select the component you wish to remove from the browse list, and change its *Selected installation action* to 'Un-install'. Repeat for all components that you no longer require, then click *OK* to perform the deinstallation.

Please be very careful not to remove components that may be needed later.

Importing Hauptwerk version 1 organs

The *File | Import Hauptwerk version 1 organ* menu function allows the current version of Hauptwerk to use Hauptwerk version 1 sample sets for backwards compatibility:



Hauptwerk cannot load or install version 1 sample sets directly, so this importing stage is necessary before a version 1 sample set can be used.

During the importing process, Hauptwerk automatically 'compiles' the version 1 organ definition file to the format required by the current version and installs its samples in appropriate folders. Once imported, the sample set will behave fully as a normal native sample set, and can be loaded from the options on the *Organ* menu as with any other sample set.

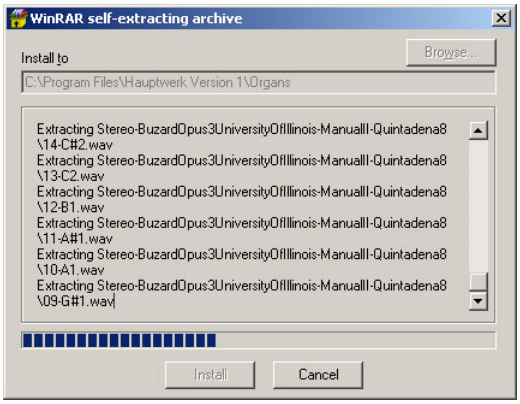
Note that Hauptwerk version 1 was a much less powerful and less realistic system than the current version, and its organ definition files contained only a tiny fraction of the information held in the current file formats. Because the information for many current features (such as the shapes of tremulant waveforms for each pipe and the wind supply model parameters) was simply not available in version 1 sample sets, Hauptwerk can only use simple defaults when importing.

Imported sample sets will look and function much as they did in version 1. They will sound much better because of the core improvements in audio quality and sample play-back inherent in the current version, but they won't be nearly as functional or realistic as a native sample set in Hauptwerk version 2 format and above.

It is thus highly preferable to obtain an official upgrade of a sample set to version 2 format or above from its supplier to simply importing its Hauptwerk 1 version in this way, since an official upgrade should contain the necessary extra media and data to take best advantage of the features available in later versions of Hauptwerk. Official upgrades are available for the vast majority of version 1 sample sets from their suppliers, or are expected in the very near future. Please contact the supplier of your sample sets for this information and for upgrade pricing. A list of all Hauptwerk sample sets is also maintained on the Hauptwerk website.

If you have a Hauptwerk version 1 sample set that you wish to use, the process is as follows:

First, if you have a Windows PC, and you have not already installed the sample set, install the version 1 sample set into a temporary folder using the instructions supplied with it. The default installation folder for version 1 sample sets was *C:\Program Files\Hauptwerk\Organs* or *C:\Program Files\Hauptwerk Version 1\Organs*:

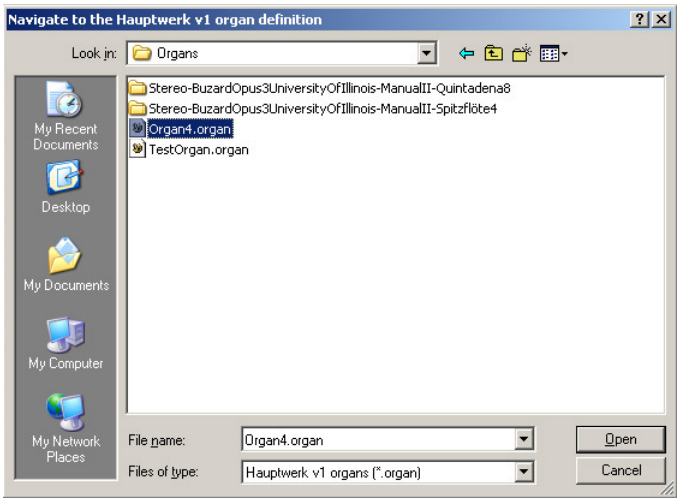


Note that Hauptwerk version 1 had no native component installer and the appearance of the installer and installation method may vary between sample sets. If you have any problems installing a version 1 sample set, please contact its supplier for advice.

Important: Hauptwerk version 1 was available for Windows PCs only. Since, unlike the current version, it had no native multi-platform component installer, many of the original third-party version 1 sample set installers will not run directly on Apple Mac computers. To import such sample sets you would either need to install them temporarily onto a Windows PC, then save the resulting extracted sample set to a CD/DVD that could be read from your Apple Mac and import from there, or contact the supplier of the sample set to see if the version 1 sample set can be supplied in a format that can be read by an Apple Mac, such as a ZIP file. Once the version 1 sample set has been extracted so that it is readable on an Apple Mac, it can be imported in Hauptwerk as normal.

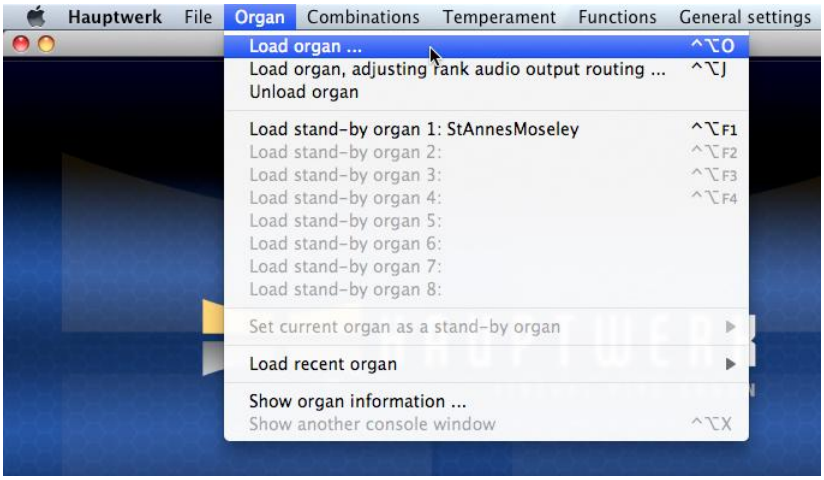
Check that no installation or extraction errors occurred during the installation process.

Now use *File | Import Hauptwerk version 1 organ* in the current version of Hauptwerk to navigate to the folder into which you installed the version 1 sample set and select its organ definition file, which will have a file extension of *.organ*:



Wait until the importing process has completed.

Now load the sample set as normal using *Organ | Load organ* in the current version of Hauptwerk to verify that it is working and has been imported successfully:



Finally, you can delete the version 1 sample set files from wherever you installed them temporarily. The original version 1 files are no longer needed once the sample set has been imported.

MIDI organ consoles

The quick start: stand-alone section covers basic configuration, and the MIDI input and MIDI output sections describe how MIDI input and output are configured generally. The MIDI implementation section also describes the range of MIDI messages Hauptwerk supports for its various types of objects.

Note that MIDI output facilities are only available in the Advanced Edition of Hauptwerk.

This section is intended to provide additional reference and suggestions for configuration when Hauptwerk is to be used as an 'engine' for a MIDI organ console or voice expander.

On a MIDI console, you may wish to include:

- MIDI output from the physical keyboards to control Hauptwerk's virtual keyboards.
- MIDI output (usually MIDI note-on/off messages) from the physical draw-knobs/tabs to control Hauptwerk's virtual stops, couplers, tremulants and other latching switches.
- MIDI output (usually MIDI program change messages) from the physical pistons/buttons to control Hauptwerk's virtual pistons.
- MIDI control change output from physical swell and crescendo pedals.
- Additional MIDI buttons (usually also MIDI program change messages) to trigger Hauptwerk's essential menu functions.
- MIDI input (usually note-on/off) to control physical draw-knob solenoids or draw-knob/tab state lamps in response to changes from Hauptwerk's combination system.
- A small number of additional indicator lamps to show Hauptwerk's system statuses (error, active, etc.).
- If you will be using multiple sample sets, then possibly also LCD panels for each physical console control so that Hauptwerk can display a label by it, appropriate to the sample set loaded.

If you intend to use Hauptwerk 'headless' - without a computer monitor, mouse or computer keyboard - the the process is as follows:

- It is simplest to choose the installation option to make Hauptwerk start automatically when the computer boots. If you have already installed Hauptwerk and did not choose that option, the same effect can be achieved on Windows systems by copying the short-cut from which you launch Hauptwerk into the *Start | Programs | Startup* program group.
- If you have not already done so, follow the Quick start: stand-alone section to perform initial configuration.
- Use the component installer to install the sample set(s) that you intend to use with Hauptwerk.
- Configure Hauptwerk's MIDI input and MIDI output systems fully for use with your console, ensuring that all essential menu functions (such as *File | Shut computer down*) are assigned to MIDI buttons. You may also wish to assign Hauptwerk's system status outputs to MIDI indicator lamps or similar.
- Configure multi-channel audio if required.
- Test the configuration thoroughly and re-configure/repeat as necessary.
- Load the sample set that you wish to use as the default.
- Select Functions | Enter capture mode.
- Select Organ | Set current organ as stand-by organ 1.
- Select Functions | Leave capture mode.
- Select Organ | Unload organ.
- Finally, use General settings | General options to set Organ loading mode when Hauptwerk starts to 'Load and activate first stand-by organ'.
- Re-boot the computer and check that Hauptwerk starts and loads the sample set automatically.
- You may also need to configure you computer's BIOS to ignore the absence of a mouse or keyboard when booting. Consult your computer documentation.
- Detach the monitor, mouse and keyboard from the computer and re-boot again to verify that everything is still working properly.

If you are building a MIDI organ console, or converting an old organ console for MIDI for use with Hauptwerk, the MIDI implementation section has the definitive information on what is supported by Hauptwerk. However, if there are no other factors, you may simply wish to design the MIDI implementation of the console to match Hauptwerk's default MIDI configuration, to minimize the time taken to re-configure Hauptwerk.

The following sections describe the default configuration installed with Hauptwerk, and make the assumption that all MIDI messages for a given channel are sent and received on the same port. The port used for each MIDI input channel can be adjusted on the *General settings | MIDI input paths* screen, and that for output on the *General settings | MIDI output paths* screen.

Important: The following sections are not requirements; they merely describe the default installed configuration in case you wish to use it unaltered. If you change the configuration via the MIDI input or output options on the *General settings* or *Organ settings* menus, then the following information may no longer apply, and you must instead use the values that you have configured.

In particular, since any of the default configuration can be changed as required, *there are no restrictions on the MIDI channels and message types that can be used to control any given virtual organ control*. For example, if you wish all draw-knobs to be controlled by MIDI note-on/off messages on a single MIDI channel, then simply create or select a MIDI input path with *General settings | Switch (MIDI) inputs* for that MIDI port and channel, change the MIDI input path settings for the relevant switches on the *General settings | Switch (MIDI) inputs* screen to use that path, re-assign their event (note) numbers as required, and optionally delete other switch (MIDI) inputs that you do not intend to use.

Keyboards

For the default configuration, set the MIDI keyboards' MIDI channels as follows, using standard note-on/off to control the virtual keys:

- Keyboards: div. 1 (Pedal) - channel 1.
- Keyboards: div. 2 (Great) - channel 2.
- Keyboards: div. 3 (Swell) - channel 3.
- Keyboards: div. 4 (Choir) - channel 4.
- Keyboards: div. 5 (Solo) - channel 5.

If you wish to use theatre organ second-touch, you must create additional keyboard MIDI input objects (and possibly additional MIDI input paths) using the *General settings | Keyboard MIDI inputs* screen.

Continuous controls (swell pedals, crescendo pedals, etc.)

For the default configuration, set the MIDI expression pedals to send on the following MIDI channels and MIDI continuous controller numbers:

- Crescendos: general - channel 7, controller number 2 (breath control).
- Swells: div. 1 (Pedal) - channel 1, controller number 1 (modulation wheel).
- Swells: div. 2 (Great) - channel 2, controller number 1 (modulation wheel).
- Swells: div. 3 (Swell) - channel 3, controller number 1 (modulation wheel).
- Swells: div. 4 (Choir) - channel 4, controller number 1 (modulation wheel).
- Swells: div. 5 (Solo) - channel 5, controller number 1 (modulation wheel).
- Swells: general - channel 7, controller number 1 (modulation wheel).

Virtual pistons

To trigger a sample set's virtual pistons using the default configuration, send a MIDI program change message with the following channels and program numbers:

- Combination pistons: div. 1 (Pedal) - channel 1, prog. 1-10.
- Combination pistons: div. 2 (Great) - channel 2, prog. 1-10.
- Combination pistons: div. 3 (Swell) - channel 3, prog. 1-10.
- Combination pistons: div. 4 (Choir) - channel 4, prog. 1-10.
- Combination pistons: div. 5 (Solo) - channel 5, prog. 1-10.
- Combination pistons: general - channel 7, prog. 1-20.
- General cancel - channel 7, prog. 64.

Virtual stops

Send MIDI note-on/off messages to turn the virtual stop switches on and off using the default configuration, with the following channels and note numbers:

- Stops: div. 1 (Pedal) - channel 8, notes 36-67.
- Stops: div. 2 (Great) - channel 9, notes 36-67.
- Stops: div. 3 (Swell) - channel 10, notes 36-67.
- Stops: div. 4 (Choir) - channel 11, notes 36-67.
- Stops: div. 5 (Solo) - channel 12, notes 36-67.

In order to view or adjust which stops are assigned to which note numbers, load the sample set then use the *Organ settings | Connect switch MIDI inputs to organ switches* screen to select the organ stops in the browse list, and view or change the input switches to which they are assigned.

Set each physical solenoid-actuated/illuminated draw-knob/tab to be controlled by a note-on/off message with the same channel and note number that it sends.

Virtual couplers

Please look at the *General settings | Switch (MIDI) inputs* screen for the full list. We will only list the commonly-used couplers here. Send MIDI note-on/off messages to turn the virtual switches on and off using the default configuration, with the following channels and note numbers:

- Couplers: div. 2 (Great) to div. 1 (Pedal) - channel 8, note 74.
- Couplers: div. 3 (Swell) to div. 1 (Pedal) - chan. 8, note 79.
- Couplers: div. 3 (Swell) to div. 1 (Pedal) oct. - chan. 8, note 80.
- Couplers: div. 4 (Choir) to div. 1 (Pedal) - chan. 8, note 84.
- Couplers: div. 4 (Choir) to div. 1 (Pedal) oct. - chan. 8, note 85.
- Couplers: div. 5 (Solo) to div. 1 (Pedal) - chan. 8, note 89.
- Couplers: div. 5 (Solo) to div. 1 (Pedal) oct. - chan. 8, note 90.
- Couplers: div. 1 (Pedal) to div. 2 (Great) bass - chan. 9, note 71.
- Couplers: div. 3 (Swell) to div. 2 (Great) sub-oct. - chan. 9, note 78.
- Couplers: div. 3 (Swell) to div. 2 (Great) - chan. 9, note 79.
- Couplers: div. 3 (Swell) to div. 2 (Great) oct. - chan. 9, note 80.
- Couplers: div. 4 (Choir) to div. 2 (Great) sub-oct. - chan. 9, note 83.
- Couplers: div. 4 (Choir) to div. 2 (Great) - chan. 9, note 84.
- Couplers: div. 4 (Choir) to div. 2 (Great) oct. - chan. 9, note 85.
- Couplers: div. 5 (Solo) to div. 2 (Great) sub-oct. - chan. 9, note 88.
- Couplers: div. 5 (Solo) to div. 2 (Great) - chan. 9, note 89.
- Couplers: div. 5 (Solo) to div. 2 (Great) oct. - chan. 9, note 90.
- Couplers: div. 1 (Pedal) to div. 3 (Swell) bass - chan. 10, note 71.
- Couplers: div. 3 (Swell) sub-oct. - chan. 10, note 78.
- Couplers: div. 3 (Swell) unison off - chan. 10, note 79.
- Couplers: div. 3 (Swell) oct. - chan. 10, note 80.
- Couplers: div. 4 (Choir) to div. 3 (Swell) sub-oct. - chan. 10, note 83.
- Couplers: div. 4 (Choir) to div. 3 (Swell) - chan. 10, note 84.
- Couplers: div. 4 (Choir) to div. 3 (Swell) oct. - chan. 10, note 85.
- Couplers: div. 5 (Solo) to div. 3 (Swell) sub-oct. - chan. 10, note 88.
- Couplers: div. 5 (Solo) to div. 3 (Swell) - chan. 10, note 89.
- Couplers: div. 5 (Solo) to div. 3 (Swell) oct. - chan. 10, note 90.
- Couplers: div. 1 (Pedal) to div. 4 (Choir) bass - chan. 11, note 71.
- Couplers: div. 3 (Swell) to div. 4 (Choir) sub-oct. - chan. 11, note 78.
- Couplers: div. 3 (Swell) to div. 4 (Choir) - chan. 11, note 79.
- Couplers: div. 3 (Swell) to div. 4 (Choir) oct. - chan. 11, note 80.
- Couplers: div. 4 (Choir) sub-oct. - chan. 11, note 83.
- Couplers: div. 4 (Choir) unison off - chan. 11, note 84.
- Couplers: div. 4 (Choir) oct. - chan. 11, note 85.
- Couplers: div. 5 (Solo) to div. 4 (Choir) sub-oct. - chan. 11, note 88.
- Couplers: div. 5 (Solo) to div. 4 (Choir) - chan. 11, note 89.
- Couplers: div. 5 (Solo) to div. 4 (Choir) oct. - chan. 11, note 90.
- Couplers: div. 5 (Solo) sub-oct. - chan. 12, note 88.
- Couplers: div. 5 (Solo) unison off - chan. 12, note 89.
- Couplers: div. 5 (Solo) oct. - chan. 12, note 90.

Again set each physical solenoid-actuated/illuminated draw-knob/tab to be controlled by a note-on/off message with the same channel and note number that it sends.

Virtual tremulants

Send MIDI note-on/off messages to turn the virtual switches on and off using the default configuration, with the following channels and note numbers:

- Tremulants: div. 1 (Pedal) main - chan. 8, note 93.
- Tremulants: div. 1 (Pedal) Tibia - chan. 8, note 94.
- Tremulants: div. 1 (Pedal) solo 1 - chan. 8, note 95.
- Tremulants: div. 1 (Pedal) solo 2 - chan. 8, note 96.
- Tremulants: div. 2 (Great) main - chan. 9, note 93.
- Tremulants: div. 2 (Great) Tibia - chan. 9, note 94.
- Tremulants: div. 2 (Great) solo 1 - chan. 9, note 95.
- Tremulants: div. 2 (Great) solo 2 - chan. 9, note 96.
- Tremulants: div. 3 (Swell) main - chan. 10, note 93.
- Tremulants: div. 3 (Swell) Tibia - chan. 10, note 94.
- Tremulants: div. 3 (Swell) solo 1 - chan. 10, note 95.
- Tremulants: div. 3 (Swell) solo 2 - chan. 10, note 96.
- Tremulants: div. 4 (Choir) main - chan. 11, note 93.
- Tremulants: div. 4 (Choir) Tibia - chan. 11, note 94.
- Tremulants: div. 4 (Choir) solo 1 - chan. 11, note 95.
- Tremulants: div. 4 (Choir) solo 2 - chan. 11, note 96.
- Tremulants: div. 5 (Solo) main - chan. 12, note 93.
- Tremulants: div. 5 (Solo) Tibia - chan. 12, note 94.
- Tremulants: div. 5 (Solo) solo 1 - chan. 12, note 95.
- Tremulants: div. 5 (Solo) solo 2 - chan. 12, note 96.

Yet again set each physical solenoid-actuated/illuminated draw-knob/tab to be controlled by a note-on/off message with the same channel and note number that it sends.

Menu functions

To trigger Hauptwerk's menu functions from push-buttons using the default configuration, send MIDI program change messages on MIDI channel 7 with the following program numbers:

- Organ | Load/assign stand-by organ 1 - prog. 21.
- Organ | Load/assign stand-by organ 2 - prog. 22.
- Organ | Load/assign stand-by organ 3 - prog. 23.
- Organ | Load/assign stand-by organ 4 - prog. 24.
- Organ | Load/assign stand-by organ 5 - prog. 25.
- Organ | Load/assign stand-by organ 6 - prog. 26.
- Organ | Load/assign stand-by organ 7 - prog. 27.
- Organ | Load/assign stand-by organ 8 - prog. 28.
- Combinations | Save combinations with an automatic filename - prog. 37.
- Combinations | Load/assign stand-by comb. file 1 - prog. 29.
- Combinations | Load/assign stand-by comb. file 2 - prog. 30.
- Combinations | Load/assign stand-by comb. file 3 - prog. 31.
- Combinations | Load/assign stand-by comb. file 4 - prog. 32.
- Combinations | Load/assign stand-by comb. file 5 - prog. 33.
- Combinations | Load/assign stand-by comb. file 6 - prog. 34.
- Combinations | Load/assign stand-by comb. file 7 - prog. 35.
- Combinations | Load/assign stand-by comb. file 8 - prog. 36.
- Combinations | Advance registration sequencer frame - prog. 38.
- Combinations | Decrement registration sequencer frame - prog. 39.
- Combinations | Re-activate current registration sequencer frame - prog. 40.
- Combinations | Go to start of registration sequencer bank 1 - prog. 41.
- Combinations | Go to start of registration sequencer bank 2 - prog. 42.
- Combinations | Go to start of registration sequencer bank 3 - prog. 43.
- Combinations | Go to start of registration sequencer bank 4 - prog. 44.
- Combinations | Go to start of registration sequencer bank 5 - prog. 45.
- Combinations | Go to start of registration sequencer bank 6 - prog. 46.
- Combinations | Go to start of registration sequencer bank 7 - prog. 47.
- Combinations | Go to start of registration sequencer bank 8 - prog. 48.
- Temperament | Equal temperament - prog. 53.
- Temperament | Original organ tuning - prog. 54.
- Temperament | Load/assign stand-by temperament 1 - prog. 49.
- Temperament | Load/assign stand-by temperament 2 - prog. 50.
- Temperament | Load/assign stand-by temperament 3 - prog. 51.
- Temperament | Load/assign stand-by temperament 4 - prog. 52.
- Functions | Reset - prog. 55.
- Functions | Clear transposer - prog. 63.
- Functions | Increment transposer by one semitone - prog. 61.
- Functions | Decrement transposer by one semitone - prog. 62.
- Functions | Clear master tuning - prog. 60.
- Functions | Increment master tuning by one percent of a semitone - prog. 58.
- Functions | Decrement master tuning by one percent of a semitone - prog. 59.

Note that there are more menu functions which can be controlled by MIDI (see the *General settings | Menu functions activated by switch (MIDI) inputs* screen for the full list); only those configured by default are listed above. Many menu functions may take a few seconds to complete, so you should allow for this when playing.

Note also that capture mode is configured to be controlled by MIDI note-on/off messages by default so that its piston must physically be held in to keep Hauptwerk in capture mode, thus preventing accidental erasing of combinations or menu stand-by assignments; see below.

System state indicators

If you have additional indicator lamps to show Hauptwerk's system states on the console, for the default configuration they should be wired to receive MIDI note-on/off messages on MIDI channel 6 with the following note numbers:

- MIDI and audio active - note 36.
- Sample set ready - note 37.
- Sample set loading - note 38.
- System error - note 39.
- Audio output being recorded - note 40.
- Capture mode (combination setter) - note 41.

LCD panels

By default no LCD panels are configured in order to minimize the time taken for activation and deactivation. However, you can configure LCD settings yourself if you wish to use LCD panel output from Hauptwerk. Please consult the MIDI output section for the MIDI system exclusive message format used.

If you require a full set of default LCD panel configuration please contact Milan Digital Audio.

Setter/capture piston

One of the most important switches to include on a console is the setter/capture switch. We recommend using a momentary push-button (piston) which sends a MIDI note-on message as you press it in, and a MIDI note-off message as it springs back out. Thus it is almost impossible to overwrite combinations or menu stand-by assignments accidentally, since Hauptwerk will only be in capture mode while the piston is physically held in.

For the default configuration, the MIDI note-on/off messages should have the following MIDI channel and note number:

- Capture mode: note-on/off, channel 7, note 56.

If your MIDI encoder for channel 7 (the utility pistons channel in the default configuration) is set to produce MIDI program change messages instead of MIDI note-on/off messages, then you can easily change the message type or channel (MIDI input path) with the *General settings | Switch (MIDI) inputs* screen. Locate the 'Util: comb capture mode' object in the browse list and change the engaging and disengaging message details.

Important: note that, because Hauptwerk's menu functions can only be triggered when a switch input is engaged (not when it is disengaged), it is necessary to have *two* switch input objects: one to enter capture mode and one to leave it, even though they may both represent the same physical MIDI button. Thus it is the *engaging* event for each that must be used, but in opposite ways, while the disengaging event for each should be set to 'Automatic'. Look at how the two default switch inputs are configured to clarify this point.

If separate MIDI pistons are used to enter capture mode and leave it, then the configuration is more logical, but there is a much greater risk of accidentally leaving the system in capture mode since you would not need to hold the piston in physically.

MIDI sequencing

The quick start: MIDI sequencing section covers basic configuration for use with a non-VST compatible MIDI sequencer, using a virtual MIDI cable such as the IAC Driver on an Apple Mac or MIDI Yoke or LoopBe on a Windows PC. The quick start: VSTi plug-in section covers the same material for use with a VST-compatible sequencer, such as Steinberg Cubase.

This section is intended to provide additional reference applicable to both types of sequencer.

Except for the *General settings | MIDI input paths* screen, where it will have been necessary to change the *MIDI input port* setting for non-VSTi use, the default MIDI input and output configuration installed with Hauptwerk would not normally need to be changed for use with either type of sequencer, and is intended to be sufficiently comprehensive.

For non-VSTi use, if the MIDI input port was changed to the first virtual MIDI cable as suggested in the quick start section, then all sequencer tracks that you wish to route to Hauptwerk should send their output to that port for simplicity. Thus it is only necessary to change the track's channel and contents to control different aspects of Hauptwerk's behavior.

Similarly for VSTi use, a track's output needs to be routed to the instance of the Hauptwerk VST plug-in, with the track's channel and contents determining Hauptwerk's actions. Note that only one instance of the Hauptwerk plug-in is allowed to run at any one time.

IMPORTANT: in the MIDI sequencer program's settings make sure that **only** your virtual MIDI cable port(s) are enabled as MIDI output(s) but that the **virtual MIDI cable port(s) are disabled as MIDI input(s)**. Failing to do this is likely to give MIDI feedback, which is likely to lead crashes, freezes or strange effects such as notes or stops turning each other on/off, or to lead to Hauptwerk and the sequencer program trying to use a given MIDI port at the same time, and thus giving an error message.

The following sections describe how to use the default MIDI input configuration installed with Hauptwerk. If you change the configuration via the MIDI input options on the *General settings* or *Organ settings* menus (as described in the MIDI input and MIDI output sections), then the following information may no longer apply, and you must instead use the values that you have configured.

Keyboards

For the default configuration, provided that the sample set includes the relevant keyboard, simply set the track's MIDI channel as follows to route to a given virtual organ keyboard, using note-on/off messages to control the virtual keys:

- Keyboards: div. 1 (Pedal) - channel 1.
- Keyboards: div. 2 (Great) - channel 2.
- Keyboards: div. 3 (Swell) - channel 3.
- Keyboards: div. 4 (Choir) - channel 4.
- Keyboards: div. 5 (Solo) - channel 5.

Note that routing MIDI to Hauptwerk in this way enables Hauptwerk's couplers and stops to work as normal. In particular, you will not hear any sound unless a stop is engaged on the relevant division for the keyboard.

Continuous controls (swell pedals, crescendo pedals, etc.)

To route MIDI to a virtual swell or crescendo using the default configuration, provided that it exists within the sample set, set the track's MIDI output channel as follows and use MIDI continuous controller messages within the track with the controller number set as follows:

- Crescendos: general - channel 7, controller number 2 (breath control).
- Swells: div. 1 (Pedal) - channel 1, controller number 1 (modulation wheel).
- Swells: div. 2 (Great) - channel 2, controller number 1 (modulation wheel).
- Swells: div. 3 (Swell) - channel 3, controller number 1 (modulation wheel).
- Swells: div. 4 (Choir) - channel 4, controller number 1 (modulation wheel).
- Swells: div. 5 (Solo) - channel 5, controller number 1 (modulation wheel).
- Swells: general - channel 7, controller number 1 (modulation wheel).

Virtual pistons

To trigger a sample set's virtual pistons using the default configuration, send a MIDI program change message with the following channels and program numbers:

- Combination pistons: div. 1 (Pedal) - channel 1, prog. 1-10.
- Combination pistons: div. 2 (Great) - channel 2, prog. 1-10.
- Combination pistons: div. 3 (Swell) - channel 3, prog. 1-10.
- Combination pistons: div. 4 (Choir) - channel 4, prog. 1-10.
- Combination pistons: div. 5 (Solo) - channel 5, prog. 1-10.
- Combination pistons: general - channel 7, prog. 1-20.
- General cancel - channel 7, prog. 64.

Virtual stops

Send MIDI note-on/off messages to turn the virtual stop switches on and off using the default configuration, with the following channels and note numbers:

- Stops: div. 1 (Pedal) - channel 8, notes 36-67.
- Stops: div. 2 (Great) - channel 9, notes 36-67.
- Stops: div. 3 (Swell) - channel 10, notes 36-67.
- Stops: div. 4 (Choir) - channel 11, notes 36-67.
- Stops: div. 5 (Solo) - channel 12, notes 36-67.

In order to view or adjust which stops are assigned to which note numbers, load the sample set then use the *Organ settings | Connect switch MIDI inputs to organ switches* screen to select the organ stops in the browse list, and view or change the input switches to which they are assigned.

Virtual couplers

Please look at the *General settings | Switch (MIDI) inputs* screen for the full list. We will only list the commonly-used couplers here. Send MIDI note-on/off messages to turn the virtual switches on and off using the default configuration, with the following channels and note numbers:

- Couplers: div. 2 (Great) to div. 1 (Pedal) - channel 8, note 74.
- Couplers: div. 3 (Swell) to div. 1 (Pedal) - chan. 8, note 79.
- Couplers: div. 3 (Swell) to div. 1 (Pedal) oct. - chan. 8, note 80.
- Couplers: div. 4 (Choir) to div. 1 (Pedal) - chan. 8, note 84.
- Couplers: div. 4 (Choir) to div. 1 (Pedal) oct. - chan. 8, note 85.
- Couplers: div. 5 (Solo) to div. 1 (Pedal) - chan. 8, note 89.
- Couplers: div. 5 (Solo) to div. 1 (Pedal) oct. - chan. 8, note 90.
- Couplers: div. 1 (Pedal) to div. 2 (Great) bass - chan. 9, note 71.
- Couplers: div. 3 (Swell) to div. 2 (Great) sub-oct. - chan. 9, note 78.
- Couplers: div. 3 (Swell) to div. 2 (Great) - chan. 9, note 79.
- Couplers: div. 3 (Swell) to div. 2 (Great) oct. - chan. 9, note 80.
- Couplers: div. 4 (Choir) to div. 2 (Great) sub-oct. - chan. 9, note 83.
- Couplers: div. 4 (Choir) to div. 2 (Great) - chan. 9, note 84.
- Couplers: div. 4 (Choir) to div. 2 (Great) oct. - chan. 9, note 85.
- Couplers: div. 5 (Solo) to div. 2 (Great) sub-oct. - chan. 9, note 88.
- Couplers: div. 5 (Solo) to div. 2 (Great) - chan. 9, note 89.
- Couplers: div. 5 (Solo) to div. 2 (Great) oct. - chan. 9, note 90.
- Couplers: div. 1 (Pedal) to div. 3 (Swell) bass - chan. 10, note 71.
- Couplers: div. 3 (Swell) sub-oct. - chan. 10, note 78.
- Couplers: div. 3 (Swell) unison off - chan. 10, note 79.
- Couplers: div. 3 (Swell) oct. - chan. 10, note 80.
- Couplers: div. 4 (Choir) to div. 3 (Swell) sub-oct. - chan. 10, note 83.
- Couplers: div. 4 (Choir) to div. 3 (Swell) - chan. 10, note 84.
- Couplers: div. 4 (Choir) to div. 3 (Swell) oct. - chan. 10, note 85.
- Couplers: div. 5 (Solo) to div. 3 (Swell) sub-oct. - chan. 10, note 88.
- Couplers: div. 5 (Solo) to div. 3 (Swell) - chan. 10, note 89.
- Couplers: div. 5 (Solo) to div. 3 (Swell) oct. - chan. 10, note 90.
- Couplers: div. 1 (Pedal) to div. 4 (Choir) bass - chan. 11, note 71.
- Couplers: div. 3 (Swell) to div. 4 (Choir) sub-oct. - chan. 11, note 78.
- Couplers: div. 3 (Swell) to div. 4 (Choir) - chan. 11, note 79.
- Couplers: div. 3 (Swell) to div. 4 (Choir) oct. - chan. 11, note 80.
- Couplers: div. 4 (Choir) sub-oct. - chan. 11, note 83.
- Couplers: div. 4 (Choir) unison off - chan. 11, note 84.
- Couplers: div. 4 (Choir) oct. - chan. 11, note 85.
- Couplers: div. 5 (Solo) to div. 4 (Choir) sub-oct. - chan. 11, note 88.
- Couplers: div. 5 (Solo) to div. 4 (Choir) - chan. 11, note 89.
- Couplers: div. 5 (Solo) to div. 4 (Choir) oct. - chan. 11, note 90.
- Couplers: div. 5 (Solo) sub-oct. - chan. 12, note 88.
- Couplers: div. 5 (Solo) unison off - chan. 12, note 89.
- Couplers: div. 5 (Solo) oct. - chan. 12, note 90.

Virtual tremulants

Send MIDI note-on/off messages to turn the virtual switches on and off using the default configuration, with the following channels and note numbers:

- Tremulants: div. 1 (Pedal) main - chan. 8, note 93.
- Tremulants: div. 1 (Pedal) Tibia - chan. 8, note 94.
- Tremulants: div. 1 (Pedal) solo 1 - chan. 8, note 95.
- Tremulants: div. 1 (Pedal) solo 2 - chan. 8, note 96.
- Tremulants: div. 2 (Great) main - chan. 9, note 93.
- Tremulants: div. 2 (Great) Tibia - chan. 9, note 94.
- Tremulants: div. 2 (Great) solo 1 - chan. 9, note 95.
- Tremulants: div. 2 (Great) solo 2 - chan. 9, note 96.
- Tremulants: div. 3 (Swell) main - chan. 10, note 93.
- Tremulants: div. 3 (Swell) Tibia - chan. 10, note 94.
- Tremulants: div. 3 (Swell) solo 1 - chan. 10, note 95.
- Tremulants: div. 3 (Swell) solo 2 - chan. 10, note 96.
- Tremulants: div. 4 (Choir) main - chan. 11, note 93.
- Tremulants: div. 4 (Choir) Tibia - chan. 11, note 94.
- Tremulants: div. 4 (Choir) solo 1 - chan. 11, note 95.
- Tremulants: div. 4 (Choir) solo 2 - chan. 11, note 96.
- Tremulants: div. 5 (Solo) main - chan. 12, note 93.
- Tremulants: div. 5 (Solo) Tibia - chan. 12, note 94.
- Tremulants: div. 5 (Solo) solo 1 - chan. 12, note 95.
- Tremulants: div. 5 (Solo) solo 2 - chan. 12, note 96.

Menu functions

To trigger Hauptwerk's menu functions from a sequencer track using the default configuration, send MIDI program change messages on MIDI channel 7 with the following program numbers:

- Organ | Load/assign stand-by organ 1 - prog. 21.
- Organ | Load/assign stand-by organ 2 - prog. 22.
- Organ | Load/assign stand-by organ 3 - prog. 23.
- Organ | Load/assign stand-by organ 4 - prog. 24.
- Organ | Load/assign stand-by organ 5 - prog. 25.
- Organ | Load/assign stand-by organ 6 - prog. 26.
- Organ | Load/assign stand-by organ 7 - prog. 27.
- Organ | Load/assign stand-by organ 8 - prog. 28.
- Combinations | Save combinations with an automatic filename - prog. 37.
- Combinations | Load/assign stand-by comb. file 1 - prog. 29.
- Combinations | Load/assign stand-by comb. file 2 - prog. 30.
- Combinations | Load/assign stand-by comb. file 3 - prog. 31.
- Combinations | Load/assign stand-by comb. file 4 - prog. 32.
- Combinations | Load/assign stand-by comb. file 5 - prog. 33.
- Combinations | Load/assign stand-by comb. file 6 - prog. 34.
- Combinations | Load/assign stand-by comb. file 7 - prog. 35.
- Combinations | Load/assign stand-by comb. file 8 - prog. 36.
- Combinations | Advance registration sequencer frame - prog. 38.
- Combinations | Decrement registration sequencer frame - prog. 39.
- Combinations | Re-activate current registration sequencer frame - prog. 40.
- Combinations | Go to start of registration sequencer bank 1 - prog. 41.
- Combinations | Go to start of registration sequencer bank 2 - prog. 42.
- Combinations | Go to start of registration sequencer bank 3 - prog. 43.
- Combinations | Go to start of registration sequencer bank 4 - prog. 44.
- Combinations | Go to start of registration sequencer bank 5 - prog. 45.
- Combinations | Go to start of registration sequencer bank 6 - prog. 46.
- Combinations | Go to start of registration sequencer bank 7 - prog. 47.
- Combinations | Go to start of registration sequencer bank 8 - prog. 48.
- Temperament | Equal temperament - prog. 53.
- Temperament | Original organ tuning - prog. 54.
- Temperament | Load/assign stand-by temperament 1 - prog. 49.
- Temperament | Load/assign stand-by temperament 2 - prog. 50.
- Temperament | Load/assign stand-by temperament 3 - prog. 51.
- Temperament | Load/assign stand-by temperament 4 - prog. 52.
- Functions | Reset - prog. 55.
- Functions | Clear transposer - prog. 63.
- Functions | Increment transposer by one semitone - prog. 61.
- Functions | Decrement transposer by one semitone - prog. 62.
- Functions | Clear master tuning - prog. 60.
- Functions | Increment master tuning by one percent of a semitone 58.
- Functions | Decrement master tuning by one percent of a semitone - prog. 59.

Note that there are more menu functions which can be controlled by MIDI (see the *General settings | Menu functions activated by switch (MIDI) inputs* screen for the full list); only those configured by default are listed above. Many menu

functions may take a few seconds to complete, so you should allow for this when playing, or triggering them from a sequencer track.

For example, to specify that a sequencer track should use the original organ tuning, you would simply need to include a MIDI program change message for program number 54 on channel 7, sending to the first virtual MIDI cable port.

Note that, by default, the capture mode menu functions are not assigned to use MIDI program change messages; see below.

Capture mode

With the default configuration, Hauptwerk's capture mode (setter) is controlled by MIDI note-on/off messages:

- Capture mode: note-on/off, channel 7, note 56.

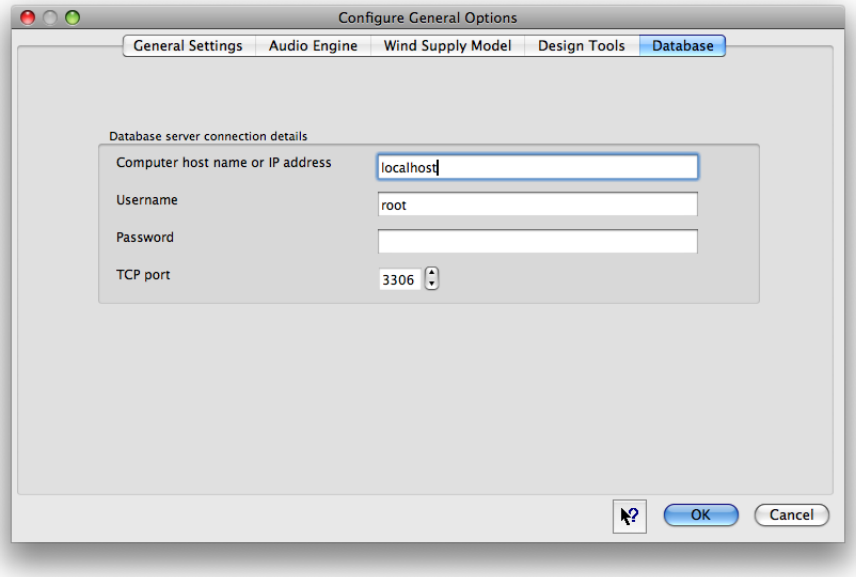
Organ design tools

The *Design tools* menu contains options to assist with creating sample sets for Hauptwerk:

It also contains the *Design tools | Load custom organ* function, which forms the core of the Custom Organ Design Module. Using this option, you can create your own organs quickly and easily, utilizing existing ranks of samples in Hauptwerk version 2 format and above, by creating a custom organ definition file in a text or XML editor. The menu option loads such a custom organ definition file, compiles it into a standard Hauptwerk organ definition file, and then loads it as normal.

The *Custom Organ Design Module User Guide* is a separate manual, available on the Help menu, which covers the module and its use in depth. Please consult that manual if you are interested in using the module.

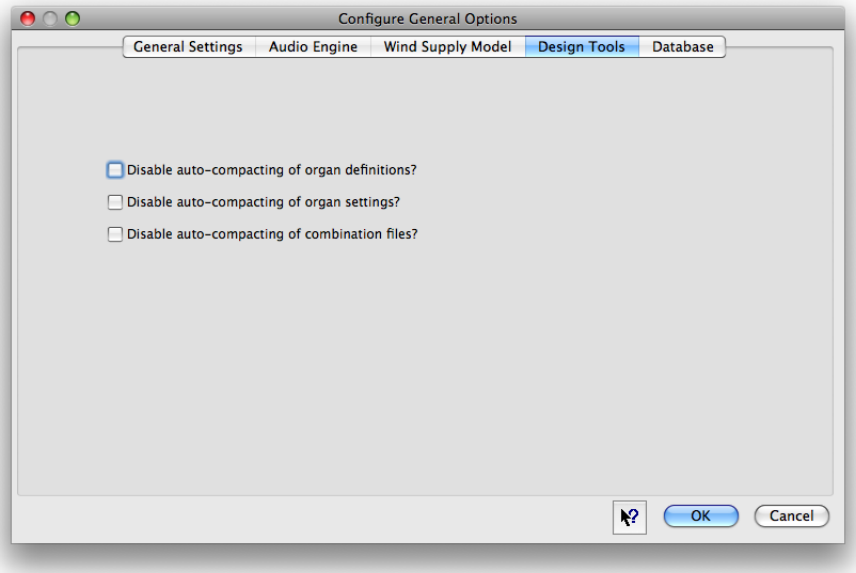
If you have purchased a license for the MySQL integration option, the *Design tools* menu will also contain functions to load organ definitions from a MySQL database, and to export them to such a database. A *Database* tab will also then be present on the *General settings | General options* screen, with which you can adjust the connection details for the MySQL Server:



Use of the MySQL interface, and of the options on the menu is covered in the *Creating Sample Sets for Hauptwerk* guide. Please contact us if you would like to receive more information.

Please note: if you have not purchased the MySQL integration option you will only see the *Load organ (with design options)* and *Load custom organ* items on the *Design tools* menu, since the remaining items relate only to the MySQL integration option.

The *General settings | General options* screen also has a tab called *Design tools*:



By default, whenever Hauptwerk saves an organ definition file, combination file or any settings file, it automatically omits any parameter in the XML file if no value has been specified for it, or if the value specified corresponds to the fixed default for that parameter. Doing so makes the XML file much smaller and allows it load much faster. However, if you are a sample set developer and want to edit the XML files using a text or XML editor you might want all available parameters to be visible in an XML file. Ticking the *Disable auto-compacting ...* options does that. Please leave the options un-ticked in all other cases, since ticking them can make loading organs, combination files and settings very significantly slower.

Note that the *Design tools | Load organ (with design options)* function can also be used to force all control mappings (those corresponding to the objects on the screens under the *Organ settings* menu) to be re-defaulted.

Performance tuning

There are several key goals when optimizing Hauptwerk and its computer:

- ***Maximizing polyphony***. The (static) polyphony is the approximate number of pipes that Hauptwerk can sound simultaneously without being overloaded. For a full discussion of polyphony, please see the computer specs section on the Hauptwerk website, and also the section below. Note especially that 'wet' (reverberant) sample sets need higher polyphony than dry since each release sample (reverb tail) continues to consume a voice of polyphony until it has completely died away.
- ***Minimizing latency***. Latency is the delay between pressing a key on the MIDI keyboard and hearing the corresponding sound from Hauptwerk. All digital audio instruments require a certain amount of latency since the audio output is generated in small chunks, and time is required to calculate them. When playing Hauptwerk live, you would normally want Hauptwerk to respond as immediately as possible. For sequencer use latency is usually much less important.
- ***Eliminating audio glitches***. If the computer becomes overloaded, a digital instrument may be unable to calculate the audio output fast enough, and an unpleasant audible glitch can occur in the output. Hauptwerk has mechanisms designed to eliminate this problem, but it is important to tune Hauptwerk and the computer appropriately in order that they can work properly.
- ***Setting audio levels optimally***. To produce the best quality audio output, the levels should be set as high as possible, without allowing clipping to occur. Clipping causes unpleasant audio distortion.
- ***Maximizing audio quality and realism***. Many sample sets optionally support high-resolution audio, and some of Hauptwerk's processor-intensive models can be disabled to improve polyphony at the expense of realism. Similarly, options exist to try to make a sample set usable within a limited amount of memory.
- ***Eliminating background noise***. Audio or sound cards can sometimes produce background digital crackling due to hardware or software resource contention, which should be eliminated.
- ***Minimizing sample set loading times***.

Audio interface and drivers

The quality of the audio interface has an enormous effect on the quality of the sound you will hear from Hauptwerk, as well as an enormous effect on its performance (both polyphony and latency). It is hard to stress this point enough. For example, with some high-quality professional-grade audio interfaces it is even possible to play twice as many pipes at once in Hauptwerk compared to some low-cost consumer sound cards. Similarly, the difference in overall latency usable in Hauptwerk can differ from 3-7 milliseconds for a high-end interface to 100 milliseconds for a poor-quality one.

You are also very unlikely to get satisfactory high-quality audio from a cheap sound card designed for playing computer games. There is little point spending a large amount of money on a fast computer to run Hauptwerk and then economizing on the audio interface, which is perhaps the most crucial component in the system. Simple basic professional audio interfaces will give very good results and are not particularly expensive. Good-quality amplifiers and speakers or headphones are of course also important.

Before attempting to optimize Hauptwerk's performance in any other way, we strongly recommend ensuring that you have the latest operating system updates applied, including the latest version of DirectX on Windows platforms, and the latest version of your audio interface's drivers. Driver versions can make a very big difference to the latency that can be achieved and can also eliminate background crackle and other problems.

For Windows platforms, ASIO drivers usually give much better performance than DirectSound drivers, and are available with almost all professional audio interfaces. Except for some Creative sound cards (whose ASIO drivers do not support multiple sample rates, which are usually required by Hauptwerk), if a native (manufacturer-supplied) ASIO driver is available we would strongly recommend using it. Hauptwerk's audio driver can be changed using the *General settings | Audio*

outputs screen (only one distinct driver can be used for ASIO). Note also that a considerably higher polyphony is possible with 64-bit versions of Windows than with 32-bit versions, provided that a 64-bit processor is installed in the computer.

You should always make sure you have the native (manufacturer-supplied) driver for your audio interface selected, and not an emulated driver. Emulated drivers very often give very poor performance indeed, commonly giving audio glitches, distortion, high latency or low polyphony. Ensuring that you have the latest driver for your audio interface, and have selected the correct entry for it on the *General settings* | *Audio outputs* screen is an absolutely essential first step for obtaining good performance from Hauptwerk.

Light background crackle from an audio interface is usually caused by hardware resource contention or heavy traffic on the computer's bus to which it is connected. With PCI/PCIe cards, moving the card to another slot often cures the problem. Attempt to avoid situating a PCI/PCIe audio card in a slot which shares any hardware resource (for example, a PC IRQ/interrupt) or bus with a high-traffic device, such as a graphics card or disk controller.

Try to avoid having firewire/USB audio interfaces sharing a firewire/USB port or firewire/USB controller with any other device. If possible, try to ensure that an audio interface doesn't share any resources with any other device at all. Try firewire audio/USB interfaces in each possible firewire port and PCI/PCIe cards in each possible slot, and ensure that a firewire/USB audio interface is connected directly to a port on the computer, rather than via a hub or another device.

If you have problems with general crackling, disconnect all unnecessary hardware from the computer, such as spurious firewire or USB devices or PCI/PCIe cards to see if that eliminates the problem.

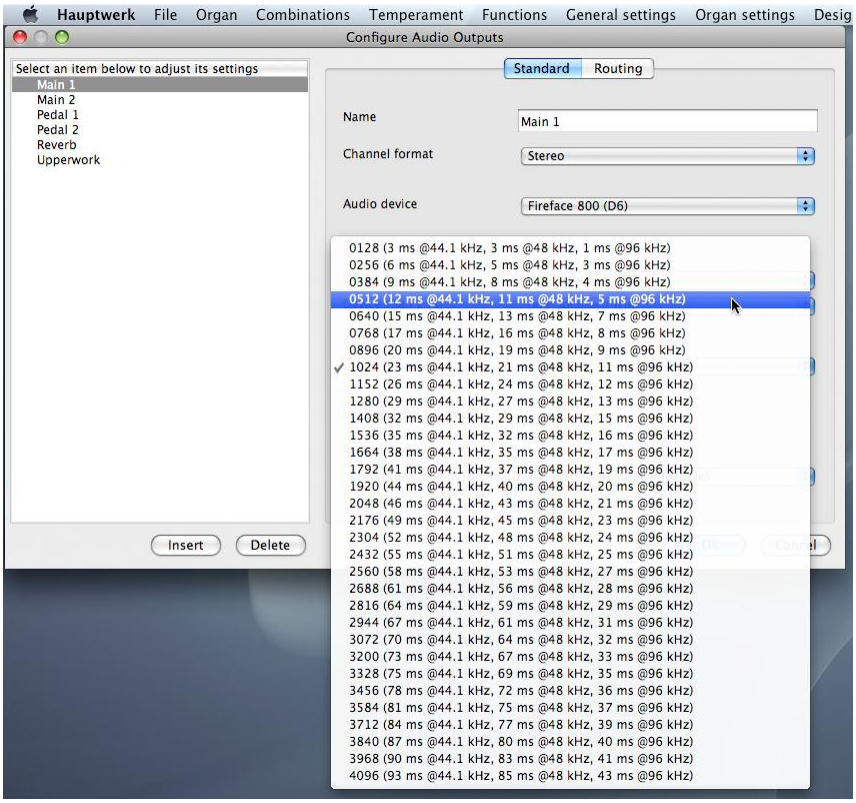
Buffer sizes and latency

The audio output is calculated in very small chunks at regular time intervals. The *buffer size* determines the size of these chunks and hence the amount of constant delay that is introduced between pressing a note and its sound being heard through your audio output, termed the *latency*.

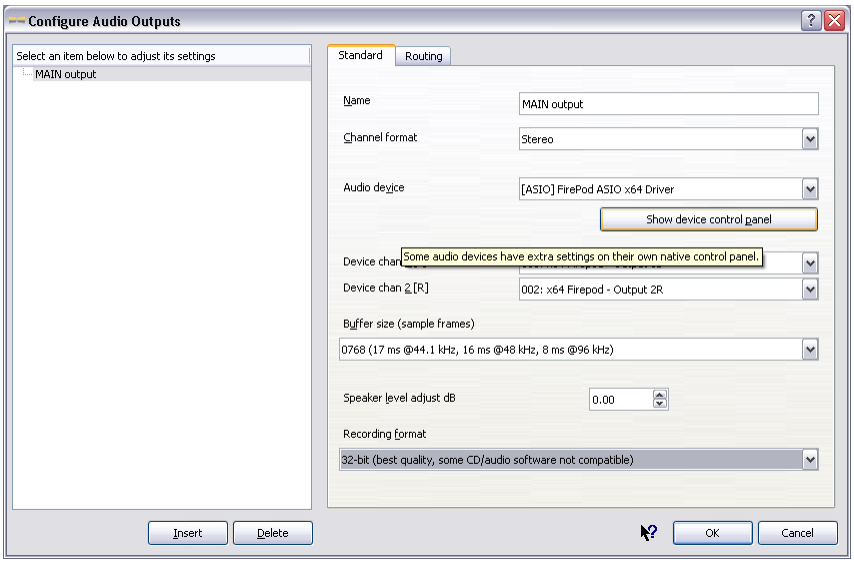
Smaller buffer sizes give smaller latencies, and thus make the virtual organ more responsive for playing in real-time. However, below a certain limit, smaller buffer sizes also increase the load on the computer's processor(s), which can lead to a lower polyphony being achievable. A balance must thus be struck.

Note that the audio interface hardware, its driver and your buffer size setting determine the latency, not Hauptwerk itself. High-end professional audio interfaces (e.g. from RME and MOTU) are specially-designed to give very high performance even at very low latencies.

The buffer size is adjusted on the *General settings | Audio outputs* screen:



Before adjusting the buffer size, make absolutely certain that you have the correct and most current manufacturer-supplied driver selected on the screen, as discussed above. Note that some Windows ASIO drivers only allow the buffer size to be adjusted via the manufacturer-supplied ASIO control panel. If Hauptwerk's buffer size setting is having no effect, click on the *Show device control panel* button and try adjusting the buffer size there:



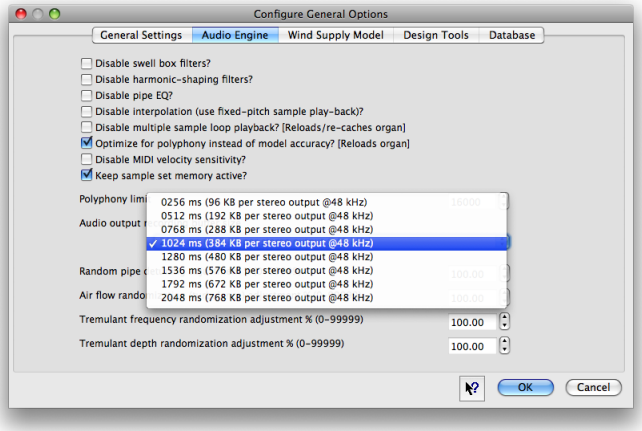
On Apple Macs or Windows PCs with ASIO drivers we would normally recommend a buffer size of 1024 samples (23 milliseconds at 44.1 kHz) as a starting point, which should always give reliable operation with almost all audio interfaces. On Windows PCs with DirectSound drivers, start with a buffer size of 2048 samples (46 milliseconds at 44.1 kHz). You can then try smaller buffer sizes to give a faster response (lower latency) if your driver supports it, usually at the expense of a little polyphony when the buffer size falls below a certain threshold. Most professional audio interfaces can work well with a buffer size of 512 samples (12 milliseconds at 44.1 kHz) without a noticeable drop in polyphony.

On Windows PCs, sometimes certain small DirectSound buffer sizes work, whereas medium sizes do not. Hence we recommend trying each buffer size from the smallest setting in *increasing* size order until a sound can be played in Hauptwerk without the audio crackling. If the audio interface driver's control panel also has a buffer size setting, it may also have an effect on DirectSound the driver and be necessary to experiment with different combinations of the two. Most DirectSound drivers will work with a latency of between 3 and 23 milliseconds. Note, however that, also unlike ASIO, DirectSound itself and the drivers often introduce considerable additional 'invisible' latency, which cannot be queried by Hauptwerk, so the true latency can sometimes be as much as twice the value indicated by the Hauptwerk buffer size.

Under no circumstances should you select a Windows DirectSound audio device that has an '(emulated)' suffix in the list of audio devices on the *General settings | Audio outputs* screen, since performance will be very poor.

On Windows PCs, for the same reason you should avoid any 'ASIO DirectX ...' and 'ASIO Multimedia Driver' driver entries if they are present. Note also that we have not found the freeware third-party 'ASIO4All' driver to give good performance with Hauptwerk, since it gives a large reduction in polyphony.

If you hear any audio glitches in Hauptwerk's output while it is recording but not at other times, or find any glitches in the resulting audio file, try increasing the *Audio output recording buffer size* setting on the *General settings | General options* screen:



The setting determines the maximum amount of time Hauptwerk allows your hard-disk to write a chunk of streamed audio to disk before an audio glitch will be heard or recorded. The default setting should be fine for most modern hard-disks but if you have an old or slow disk or are recording a lot of audio outputs simultaneously then it might be necessary to increase this setting. Larger values use a little more memory.

Memory and rank routing

Hauptwerk needs to keep all audio sample data in memory in order to achieve the very high polyphony for which it is designed, and which is necessary to model a pipe organ effectively. It does not stream samples from hard-disk drives, since

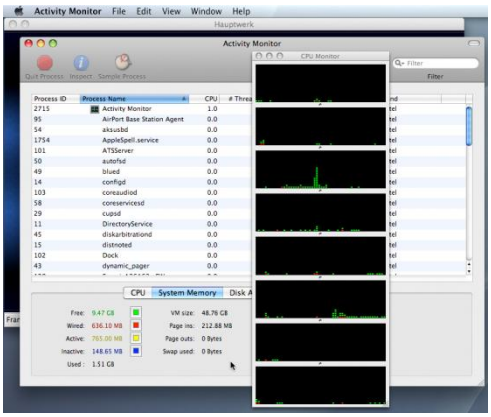
that is not presently able to provide sufficient performance in most cases, without a very high expenditure on many disk drives, resulting in higher hardware cost than using memory.

If you try to load a sample set that will not fit into the free memory available, then performance will usually be terrible, since the samples may be cached ('paged') onto the computer's hard-disk by the operating system. The total of your computer's physical memory and its disk cache ('page file') is termed its 'virtual memory'. If Hauptwerk's pipe samples have been cached to disk then the operating system will not have time to re-load them when you play the corresponding note(s), causing significant audio interruptions, or the need for an extremely audio large buffer size. The most obvious symptom of your memory having been over-filled is that the audio might break up when you play a given note the first or second time, but not subsequent times. That happens because the operating system will re-load the pipe sample data for the note from its disk cache when Hauptwerk tries to access it, i.e. when you first play the corresponding note.

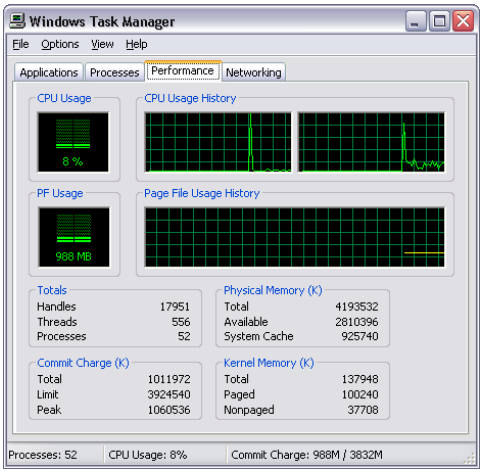
If you experience problems with latency or audio breaking up, please make sure that have sufficient free memory for the sample set you are loading. The creator of a sample set will usually state the memory it requires. Under Windows 2000 and XP, look at the *Performance* tab after pressing *Ctrl + Alt + Del* (Task Manager) to check the memory being used. On Mac OS X, use */Applications/Utilities/Activity Monitor* (see below). Also verify that no memory is being paged to disk.

When loading a sample set, Hauptwerk constantly monitors the amount of remaining free physical memory and tries to detect when that usable physical memory is very nearly exhausted. The *Action if operating system reports low memory* setting on the *General settings | General options* screen determines what Hauptwerk does in that situation. Continuing to load in such circumstances gives a high risk of audio glitches and poor performance. In some cases (OS X Tiger, or on Windows if its page file is disabled, or if disk space is also used up) continuing can also give a significant risk of the operating system becoming unstable or the computer crashing or even corrupting your files, applications and data. In other cases (OS X Leopard or Windows if there is sufficient page file), a crash should not occur, but audio glitches are likely and the system might become unresponsive. If an error occurs the sample set data cache might also need to be regenerated. The default action is to show a warning message and ask whether to continue loading.

On Mac OS X you can verify how much memory is being used by using Finder to launch */Applications/Utilities/Activity Monitor* and looking at the memory usage figures:



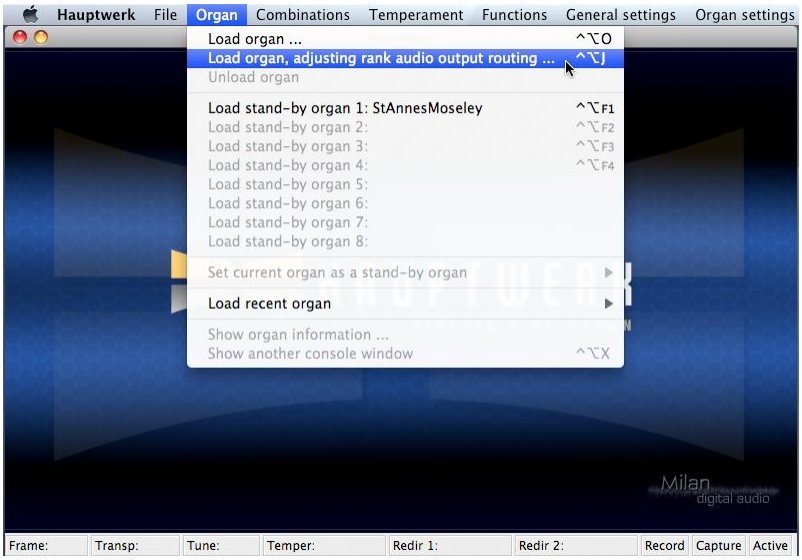
If you are running Mac OS X 10.6 'Snow Leopard' or 10.5 'Leopard', Hauptwerk's memory is included in the memory shown as 'active'. If you are using Mac OS X 10.4 'Tiger', it is instead included in the memory shown as 'wired' (cannot be paged to disk) in the pie chart. On Windows, look at the *Performance* tab after pressing *Ctrl + Alt + Del* (Task Manager) to check the memory being used:



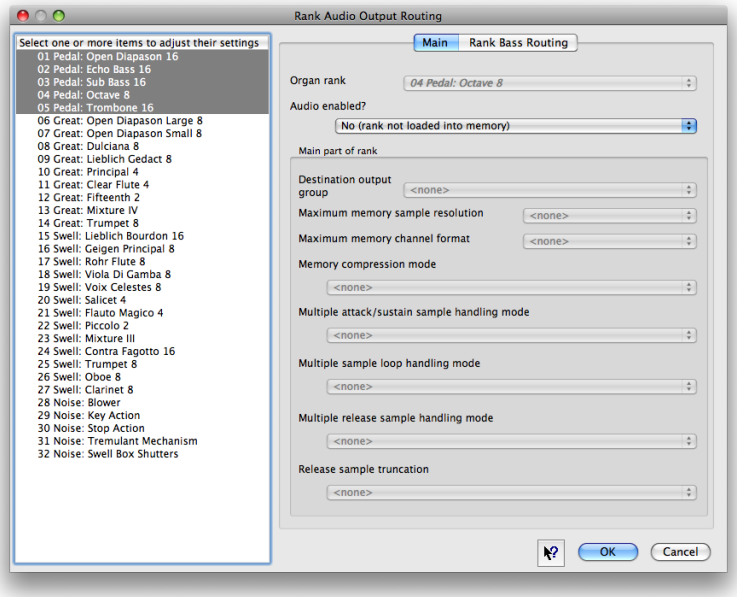
Always make sure you have sufficient free memory for the sample set you are loading.

If you find that some notes you play are unexpectedly delayed, or audio glitches start occurring, after Hauptwerk has been left with a sample set loaded for a while, especially if you have been using other applications in the meantime, then first make sure that your computer has not entered a power saving mode (we recommend making sure that all power saving features are disabled when Hauptwerk is being used) and that the sample set you're using hasn't over-filled your computer's memory. If that doesn't solve the problem, you can try ticking the *Keep sample set memory active* option on the *General settings | General options | Audio engine* screen. Doing so makes Hauptwerk refresh all of its memory periodically to try to prevent the operating system from paging the data out to disk while Hauptwerk is running, even if you are using another application at the same time. The functionality is carefully designed not to have a significant detrimental effect on performance (polyphony), but it's best to leave it disabled unless you find you need to use it.

Using the *Organ | Load organ, adjusting rank audio output routing* screen you can choose not to load some ranks to save memory, thus allowing a larger sample set to be loaded (in part) than your computer memory would normally allow:



To do so, change the *Audio enabled?* setting for one or more ranks to 'No'. Note that no automatic indication of total memory required is currently given; please consult the documentation provided with your sample sets for guidelines:



Setting *Maximum memory sample resolution* to '16-bit' (the default) causes 24/32-bit samples to be loaded in memory in 16-bit format, halving the memory requirement over loading in 24/32-bit (both 24 and 32-bit formats are loaded in 24-bit (32-bit aligned) for performance reasons). St. Anne's uses 16-bit samples, so the setting has no effect upon it. There is likely to be very little audible loss of quality in loading samples in 16-bit, since all of Hauptwerk's audio processing, mixing and audio output stages happen in higher resolutions, resulting in a much higher effective resolution than 16-bit even if the samples are loaded in 16-bit. 14 and 20-bit resolutions only offer any advantages if memory compression is enabled, since they compress much more than 16 and 24-bit respectively, thus saving a large amount of memory.

The 20-bit option is especially useful since it gives most of the audible benefits of a 24-bit resolution, but without using much more memory than loading in 16-bit without compression. Note that you might notice more hiss with the 14-bit option, due to the limitations of the lower resolution. However, it might, for example, be a useful choice for some ranks for which only a few pipes will sound at once, such as softer Pedal ranks.

The smallest Free Edition of Hauptwerk works fully with sample sets of any resolution, but allows samples to be loaded into memory in a maximum resolution of 16-bit.

Using *Memory compression mode* you can turn off loss-less memory compression for some or all ranks, typically increasing the memory required for a given rank by between 40 and 70 percent. Memory compression is enabled by default for all ranks when you load an organ for the first time. Disabling memory compression has no effect at all on audio quality but reduces the load on the computer's processor slightly, increasing the polyphony that can be achieved by between 10 and 15 percent. Hauptwerk's polyphony management system automatically takes this into account.

For most fairly recent computers the slight reduction in polyphony resulting from memory compression would not be a problem. If a sample set easily fits into memory and your processor is struggling to provide the polyphony you want, try disabling compression. If you need to increase polyphony but there is insufficient free memory to disable memory compression for all ranks, try disabling it only for ranks that place the highest demand on polyphony but leaving it enabled for those that place the least demand on polyphony, such as Pedal division ranks where typically only one pipe would sound at a time, or leaving it enabled for those ranks that are used least frequently.

(Note that Hauptwerk's loss-less memory compression is highly optimized for sample sets in native Hauptwerk version 2 format and above, and the memory saving it gives is typically less for imported version 1 sample sets.)

To save memory you can also set the *Maximum memory channel format* to 'Mono' on the routing screen. If your audio outputs are configured for stereo, then samples will be loaded into memory in mono but panned into stereo in real-time, resulting in a halving of memory requirements over true stereo, and increased polyphony (unlike Hauptwerk version 1). However, of course the result is likely to be much less realistic than use of true stereo samples. Note that mono sample sets, such as the St. Anne's, Moseley organ, are always loaded into memory in mono regardless of the setting.

Hauptwerk supports samples containing multiple loops, which it plays in a complex sequence to reduce perceived repetition. For the most realistic results, always leave *Multiple sample loop handling mode* set to 'Load all available loops (max realism, most memory)' if you have enough memory to load the whole sample set, so that all loops available in the rank's samples are used. The setting has no effect on samples with only one loop. If you select 'Load only loop which ends first (less realism, less memory)' then usually considerably less memory is required if the samples contain several loops. If a sample set is only slightly too large to fit into memory, try loading only the first loop for the least frequently-used or least prominent ranks. Note the multiple sample loop playback can also be disabled globally using the *General settings | General options* screen.

Hauptwerk also allows a sample set to include multiple real release samples for each pipe, which gives extremely realistic handling of releases, especially when playing fast passages. For the most realistic results, always leave *Multiple release sample handling mode* set to 'Load all available samples (max realism, most memory)' if you have enough memory to load the whole sample set, so that all release samples included in the sample set are used. The setting has no effect on pipes with only one release sample. If you select 'Load only default sample (less realism, less memory)' then usually considerably less memory is required if the sample set contains multiple release samples, but the virtual acoustic of the organ will sound much less convincing when playing short notes.

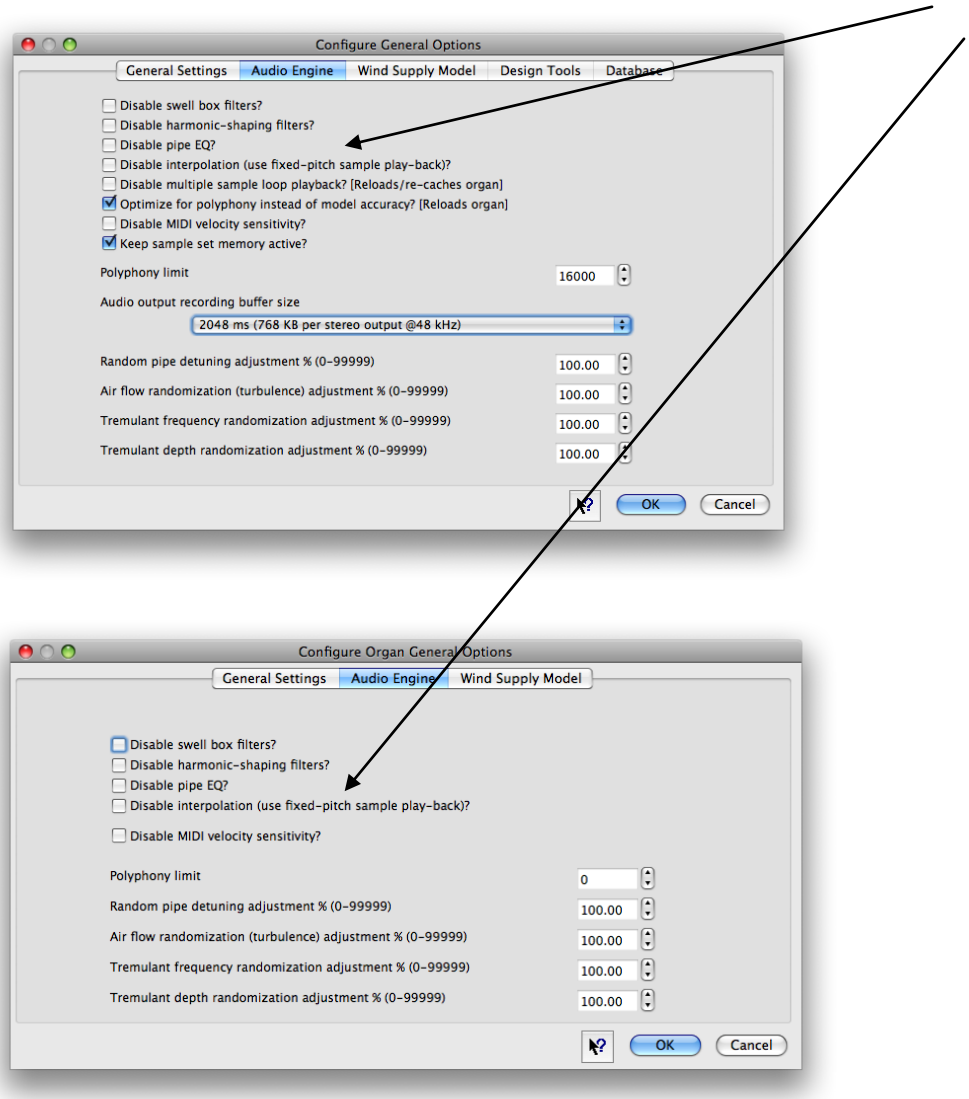
The *Multiple attack/sustain sample handling mode* setting works similarly for sample sets with several attack/sustain samples per pipe. Multiple attack/sustain samples are used in some sample sets to model a pipe organ tracker-action response, to select samples randomly to reduce repetition, to give more realistic attacks to a pipe that sounds immediately after it has stopped speaking, and to give other improvements in realism. However, if you don't have sufficient memory to load the whole sample set, it is generally best to disable multiple attack/sustain samples in preference to disabling multiple release samples, since multiple release samples give the most obvious improvement in realism.

Release sample truncation causes Hauptwerk to truncate release samples artificially, using specially-shaped frequency-dependent decays, to simulate 'dry' samples (with no reverb). With very 'wet' sample sets, which have long release samples, simulating dry samples in this way can save a considerable amount of memory. It can also allow such sample sets to be played in reverberant spaces and helps to reduce noticeable differences in acoustics when using sample sets containing samples drawn from several different sources. However, the results are never completely the same as using true dry-recorded samples, mainly because a room acoustic also affects the attack and sustaining portions of the sound, which simple truncation of releases cannot model. True dry samples are thus highly preferable to using this option, and it is recommended that it only be used as a last resort. The licenses for some sample sets do not allow modification of samples in this way, and this option is disabled for such sample sets.

In general, you should consult the documentation included with a sample set for its memory requirements and recommendations, and ensure that you never attempt to load more than will fit into your computer's memory.

Disabling Hauptwerk's models

The option which has by far the largest effect on polyphony is *Disable interpolation (use fixed-pitch playback)?* on both of the *General settings | General options* and *Organ settings | General options* screens:



Selecting the option on either screen will typically at least double the polyphony that can be achieved on a given computer (usually giving a significantly higher polyphony than was possible with Hauptwerk version 1). However, Hauptwerk's temperaments and adjustable tuning cannot be used if the option is selected, and a few sample sets cannot be loaded because they require interpolation in order to work, for example if a single pipe sample is assigned to a range of notes of different pitches. Such sample sets will give an error if you attempt to load them.

Most importantly, instruments will not have their full realism as a result of disabling interpolation (but still much better than Hauptwerk version 1). In particular, tremulants, the wind supply model and Hauptwerk's various models which impart life and movement to the sound will be much less effective with interpolation disabled. It is recommended that you only select this option if the polyphony you can achieve with your computer hardware is not adequate.

By default, Hauptwerk applies either one, two or three specially-designed real-time audio filters to each pipe individually in real-time:

- The *harmonic-shaping filter* is used to give realistic tremulants, for pipe voicing and to control the harmonic content of the pipe in responses to changes in the modeled air flow through the pipe *(*)*.
- The *swell box filter* is used only for pipes enclosed in a virtual swell box in order to shape the sound of each pipe to model the acoustic effects of a swell box.
- The *pipe EQ filter* can be applied for any given pipe by the sample set creator, or via the per-pipe voicing screen (Advanced Edition only). It is used to adjust the EQ of each pipe for voicing purposes. For most sample sets it is not applied to any pipes by default and so adds no additional processing load.

(*) The wind supply model is not currently available to customers in the U.S.A. and is only available in the Advanced Edition of Hauptwerk.

Each of these filters has a significant effect on polyphony, very approximately reducing it by 30% in each case. You can disable any or all of the filters on the *Audio Engine* tab of either of the *General settings | General options* or *Organ settings | General options* screens. However, tremulants and swell boxes will sound very noticeably less realistic without their respective filters and voicing brightness controls will no longer work. We recommend only disabling these models as a last resort.

Also on the *General settings | General options* screen, the *Optimize for polyphony instead of model accuracy?* setting can give a 20-30 percent gain in polyphony on multi-processor or multi-core computers (it has no effect on single processor/core computers), but at the expense of some tremulant and physical model realism at times of heavy polyphony load. If the performance of the tremulant, wind supply model and other physical models is important to you, we recommend not selecting the option. However, in most cases the difference is not noticeable and it is usually best to leave the option selected. In particular, since tremulants are so important for theatre organs and the tremulant model used for a theatre organ sample set typically requires a higher amount of processing power than for classical sample sets, **we recommend that *Optimize for polyphony instead of model accuracy?* should not be ticked if you use theatre organ sample sets.**

By disabling interpolation, all three types of real-time filter and multiple sample loop playback, Hauptwerk will typically achieve about three times the polyphony possible with all features enabled. Although this comes at the expense of realism, these features make it still possible to get very high performance from older computer hardware.

In particular, because the options can be defined separately for each sample set (using the *Organ settings | General options* screen), it is usually best to leave all features enabled for smaller sample sets, and fine-tune the enabled features only for larger sample sets that push the computer to its limits. You can thus get the best possible results from each sample set.

Determining and limiting polyphony

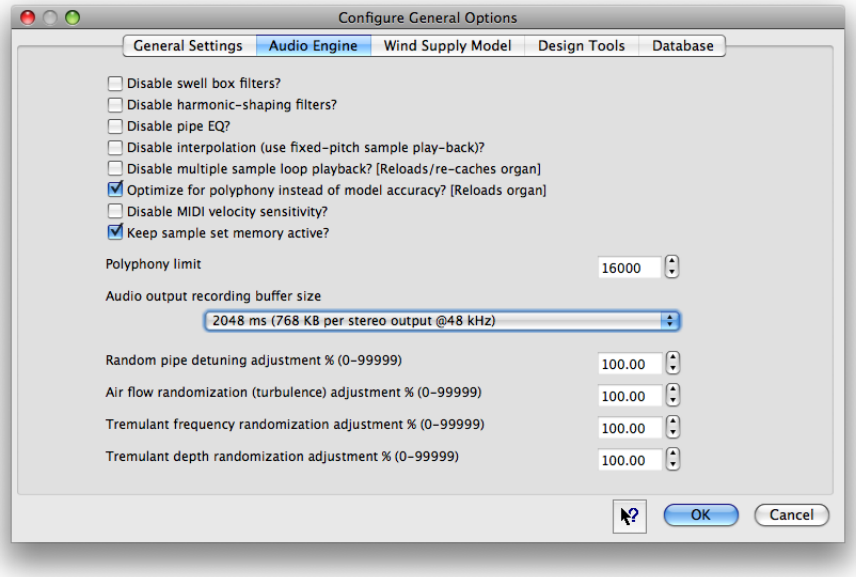
Most sample sets play one sample for each virtual pipe, although a few use multi-layered playback, where several samples play at the same time when a virtual pipe sounds to allow independent control of several aspects of the sound. Each layer consumes one voice of polyphony while it is sounding. Hence for single-layered sample sets (the most common type), one voice of polyphony is consumed per pipe while the pipe is sounding.

A pipe (layer) continues to consume a voice of polyphony until its sound has entirely died away. Thus, for sample sets with long reverberation recorded into the samples, each pipe may continue to consume a voice of polyphony for several seconds after its key has been released.

Apart from latency, the *static polyphony* is the most important basic measure of Hauptwerk's performance on a given computer. It is the number of virtual pipes that can be sustained at once without overloading the computer and without

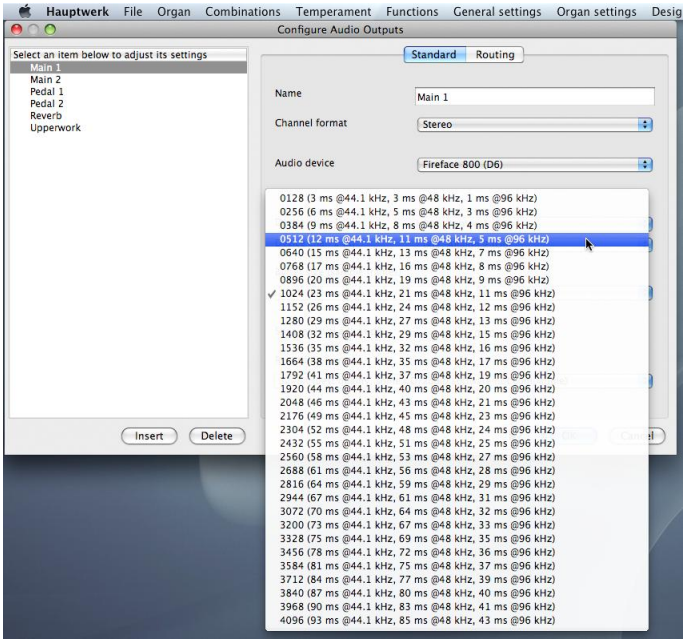
releasing and re-triggering any pipes (which would cause additional release samples to play, making accurate benchmarking difficult).

To measure the static polyphony, select *General settings* | *General options*:



Decide whether polyphony is more important than accuracy of the tremulant and physical models to you (see above), and set *Optimize for polyphony instead of model accuracy?* and *Disable interpolation (use fixed-pitch playback)?* accordingly (see above).

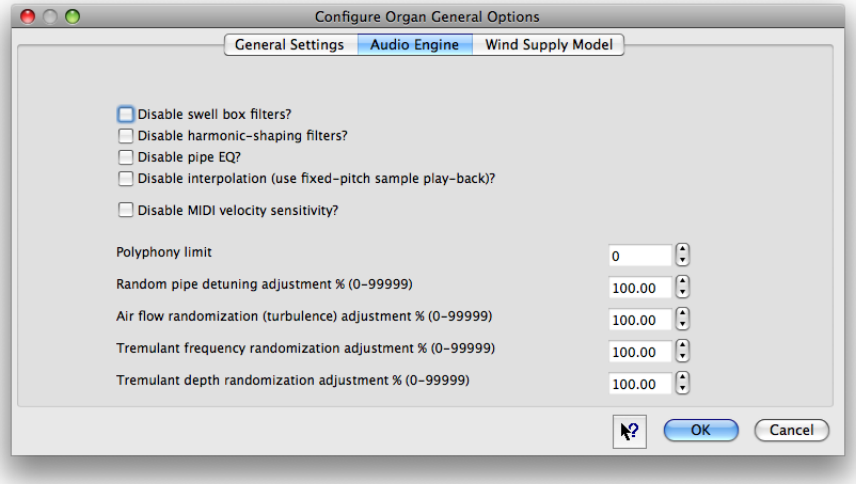
Also ensure that the audio buffer size is set to the value you wish to use on *General settings | Audio outputs*, bearing in mind that very small buffer sizes may reduce the polyphony that can be achieved, as covered above. 1024 is usually a good value to start with:



Now load one the 'polyphony testing organs' using *Organ | Load organ* from the Hauptwerk menu. The organs use ranks from the St. Anne's, Moseley sample set to create a very large instrument with up to almost 8000 virtual pipes, just for the purpose of testing polyphony. There are three variants on the polyphony testing organ for computers with different amounts of memory. First make sure that no programs other than Hauptwerk are running on the computer. If you have:

- 2 GB or more of installed memory, load the organ named *PolyphonyTestingOrgan-For2GBMemoryOrMore*.
- 1 GB or more of installed memory, load the organ named *PolyphonyTestingOrgan-For1GBMemoryOrMore*.
- 512 MB or more of installed memory, load the organ named *PolyphonyTestingOrgan-For512MBMemoryOrMore*.

Once the sample set has loaded, select *Organ settings | General options* from the menu, and view the *Audio Engine* tab. Ensure that none of the options are ticked, then click *OK*:



Change the number of pipes per key selection on the right-hand side of the screen to 50, or the highest number shown on the list if it is less than that:

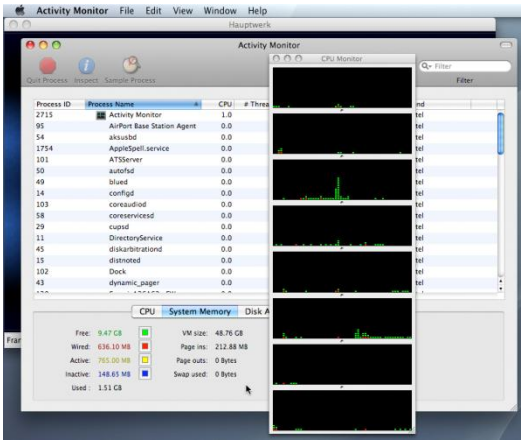
Using your arm or some books or other large objects, slowly and gently press and hold down each key successively from the bottom of the MIDI keyboard you use to play the Great virtual keyboard. Be careful not to release any keys so that no release samples are triggered, and to add keys one at a time.

As soon as the audio starts to break up, release all keys and count how many you had pressed. (Check that you can see all of the virtual keys pressed that you have pressed physically on your MIDI keyboard, since some MIDI keyboards have a limit on the number of keys that can be pressed at once.) Multiply by the number of pipes per key setting to give the static polyphony. For example, if you had been able to press 54 keys before the audio began to break up, and had selected 50 pipes per key, then your static polyphony would be 54 x 50 = 2700.

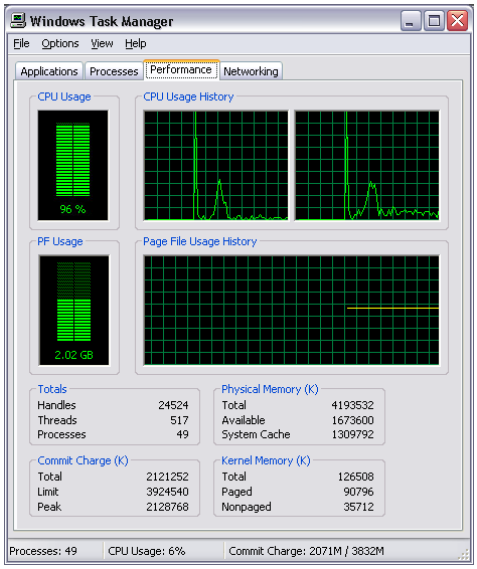
If you could press all 61 keys at once, then increase the number of pipes per key and repeat until you reach the point where the audio breaks up. Similarly, you can repeat the test with less pipes per key to obtain a more accurate measure if required.

Once you have an initial measurement, repeat the test a few times to verify the result.

On Apple Mac computers, you can use Finder to launch */Applications/Utilities/Activity Monitor* to watch the load on each available processor core during the test. Usually the audio will start to break up when the overall load on the system is between 90 and 100 percent:



On Windows systems, you can press *Ctrl + Alt + Del* to launch Task Manager and select the *Performance* tab to watch the load on each available processor core during the test. Usually the audio will start to break up when the overall load on the system is between 90 and 100 percent:



However, you should perform the final polyphony measurement without any other processor monitoring tools running, because they do have a small but significant negative impact on polyphony.

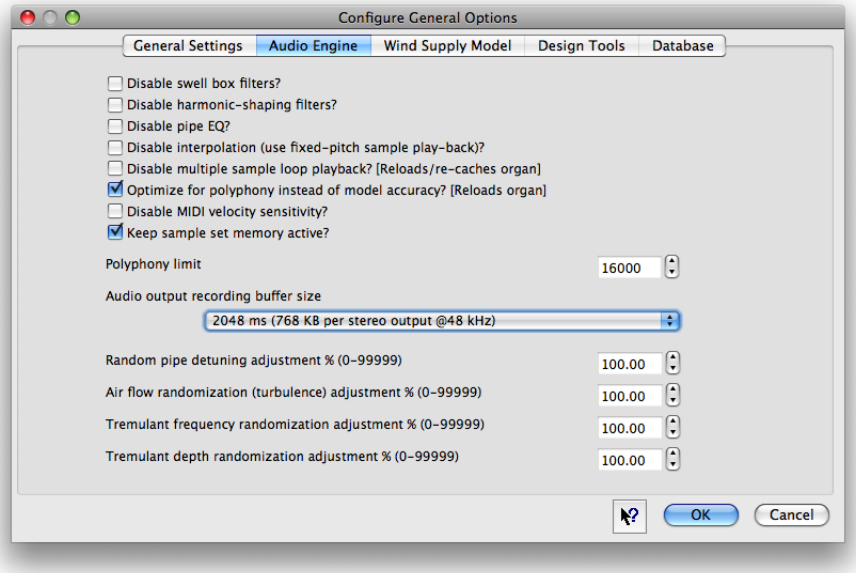
Note that the static polyphony measure is made using *mono, uncompressed, unenclosed samples* (being the type of samples and pipes used in the polyphony testing organ), but with the harmonic-shaping filters enabled. Hauptwerk automatically makes adjustments for stereo samples, enclosed pipes, and ranks for which loss-less memory compression has been enabled when applying the polyphony limit. Very approximately, playback of true stereo samples gives a reduction in polyphony of 20 percent, and enclosed pipes by 30 percent (hence a reduction of about 44 percent for stereo enclosed pipes). Loss-less memory compression typically gives a reduction in polyphony in the range of 10 to 15 percent.

Hauptwerk's polyphony limit settings are specified for *stereo, uncompressed, unenclosed* samples.

When a pipe ceases to speak, Hauptwerk performs a brief phase-aligned cross-fade from the main sustaining part of the sample to the release sample.

During this cross-fade, processing overheads increase momentarily, giving a further brief reduction in achievable polyphony of about 25 percent. However, provided that the computer is broadly powerful enough for the sample set being used, it is extremely unlikely that a significant proportion of pipes will cease to speak at exactly the same moment. You can test the exact polyphony that can be achieved when all pipes start and stop speaking at the same time using the polyphony testing organ by simply pressing and releasing all of the keys in question simultaneously, again multiplying the number of keys of by the number of ranks to obtain the final value.

Now select *General settings | General options* from the menu. On the *Audio Engine* tab, change the *Polyphony limit* to between about 30 and 40 percent of the static polyphony value you had calculated. For example, if your static polyphony was 2700, then you could set the value between 2700 x 0.3 = 810 and 2700 x 0.4 = 1080:



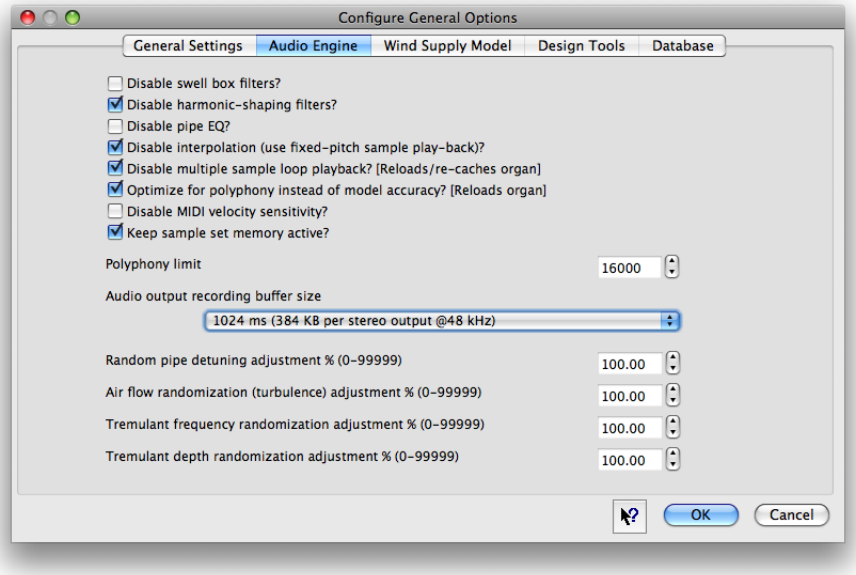
From now on, when this polyphony value is reached, Hauptwerk will start to fade out specially-selected release samples (reverb tails) to minimize any noticeable interruption or loss of pipes, while preventing the computer's processor(s) becoming overloaded and the audio breaking up. For multi-processor computers, a limit of about 35 percent of the static polyphony is often appropriate for the limit. However, for smaller computers or for theatre organ sample sets, it might be better to set the limit lower (perhaps 30 percent), since there is a greater chance that a significant proportion of the pipes will cease to speak at exactly the same time.

Provided that the limit is set correctly and that the computer is broadly powerful enough for the sample set under average load, then Hauptwerk's polyphony management algorithms can be relied upon to cope safely and unobtrusively with heavy loads, giving an appearance of unlimited polyphony. Regardless of the computer's power, if the limit is set correctly, it should never be possible for the audio to break up. The worst that can happen is that the organ may sound slightly more 'dry' in times of extreme load (if many release samples must be dropped) or, in the most extreme cases, that new pipes will not be allowed to sound.

Having set the limit, load the largest sample set you intend to play, engage as many stops as you would ever realistically use, and play it as fast as you would ever want to. You should not be able to hear the audio crackling or breaking up. If you can, set the limit a little lower and repeat the test until you cannot. If the realism of the tremulants or speed of response of the physical models (such as the wind supply model) are noticeably degraded when many pipes are sounding, also try reducing the limit and repeating the test.

Note that, if you wish, you can fine-tune the limit for each individual sample set using the *Organ settings | General options* screen. If its polyphony limit is set to a non-zero value then it overrides the global setting (on the *General settings | General options* screen), only for whichever sample set is currently loaded. This is most useful when used in combination with the other options on the screen to disable audio engine features.

For example, suppose you had several smaller sample sets which could easily be used on your computer with all audio engine features enabled, thus giving the highest possible degree of realism. However, suppose you also owned one very large sample set that pushed the computer to its limit, but you wanted to be able to use a higher polyphony to get the full 'tutti' sound from that sample set. You might then perhaps consider disabling interpolation or the harmonic-shaping filters just for that sample set, and so would be able to set the polyphony limit correspondingly higher just for that sample set:



Apart from allowing Hauptwerk's polyphony management system to ensure glitch-free audio at all times, setting the polyphony limit to the correct value for your computer is advisable because higher polyphony limit settings consume a little more memory, so having the polyphony limit set unnecessarily high wastes memory, slightly reducing the size of sample set that you can load.

Other operating system and PC optimizations and diagnostics

We recommend having as few other programs and background processes running at the same time as Hauptwerk as possible, since all running programs and processes will take processing resources away from Hauptwerk to some extent and can sometimes interrupt audio by accessing the Internet or hard-disks. There are many websites that cover optimizing particular operating systems for audio.

Some things to try (in addition to those mentioned previously) if you have problems with audio glitches on Windows PCs:

- Make sure you're using the latest version of Hauptwerk.
- If you had previously disabled the Windows page file (which was recommended for Hauptwerk 2 and earlier versions) or had adjusted Windows virtual memory settings in any other way, please make sure the page file is re-enabled and set specifically back to its default of 'system managed size'. Having it disabled or set to an inappropriate size can cause stability problems, performance problems, or other severe problems with Hauptwerk, other applications, or Windows itself, especially if 4 GB or more of memory is installed. On Windows XP use *Start | Settings | Control Panel | System*, then click on the *Performance | Settings* button on the *Advanced* tab. Select *Adjust for best performance*, then click the *Advanced* tab. Leave *Processor scheduling* and *Memory usage* both set to favor *Programs*. Click *Virtual memory: Change* and select *System managed size* for the hard-disk you want Windows to use for its virtual memory, then click *Set*. Finally click *OK* on all of the windows and re-boot the computer if you changed any settings.
- See whether the problem occurs with just a very small sample set loaded, and when just a single pipe is sounding. For example, try the free Ott Orgel sample set, which can be downloaded from our website. If so, then the problem is probably not due to insufficient memory or an incorrect polyphony limit setting.
- Make sure that all current Windows and driver updates are installed.
- Make sure that you have the latest BIOS version installed for your motherboard.
- Make sure you have the latest manufacturer-supplied ASIO driver installed and selected in Hauptwerk for your audio interface (*General settings | Audio outputs*).
- Try audio buffer sizes of 1024 and 512 in Hauptwerk on the *General settings | Audio outputs* screen. Note that some audio interface drivers ignore the buffer size that an application (such as Hauptwerk) requests, and instead always use the buffer size set in their ASIO control panel. Hence you might instead need to adjust the buffer size via their ASIO control panel, which can be accessed by clicking the *Show device control panel* button on the *General settings | Audio outputs* screen in Hauptwerk. You can determine which buffer size setting the driver is using by looking for the buffer size shown in the Hauptwerk log file (use *Help | View recent error/activity log* in Hauptwerk, scroll to the end, then look at the latest INF:5152 line).
- Try running another 'pro audio' application that uses ASIO, apart from Hauptwerk, to determine whether the problem is specific to Hauptwerk. For example Native Instruments make a Hammond organ emulation called the B4, which uses ASIO in stand-alone mode (a demo version can be downloaded from their website). Make sure that you select the same ASIO driver that you are using for Hauptwerk, and try the same audio/ASIO buffer size.
- Disconnect any hardware devices that are not absolutely essential for Hauptwerk and the computer to function, to see if that eliminates the problem. For example, disconnect all USB cameras, printers, scanners, modems, touch-screens, external hard-drives and USB hubs.
- Try disabling your motherboard's onboard audio, either in the BIOS or in Windows Device Manager (in the Windows Control Panel). Motherboard audio devices sometimes conflict with professional audio interfaces/drivers.
- Make sure that all Windows sounds are disabled (*Control Panel | Sounds ... | Sounds* and set the sound scheme to 'No sounds').

- Make sure that no other applications are running at the same time as Hauptwerk, especially applications that might try to produce any audio/sounds. In particular, check that nothing unnecessary is running in the Windows System Tray, such as media/MP3/video players or messaging applications.
- If possible, set Windows to use a device other than your main audio interface as its default device for playback and recording (*Control Panel | Sounds ... | Audio*) to try to prevent Windows or another application from trying to access the audio interface while Hauptwerk is streaming audio to it.
- Check that no hardware resources are shown as conflicting in Windows Device Manager (in the Windows Control Panel).
- Also check that no hardware resources, such as interrupts (IRQs), are being shared between your audio interface (or the firewire/IEEE 1394 controller, if the audio interface is a firewire unit) and any other key system hardware, such as the graphics card. You can check hardware resource assignments by selecting *View | Resources by type* in Windows Device Manager (in the Windows Control Panel). If your audio interface or firewire controller are sharing any hardware resources then try moving the audio interface or graphics card (or whichever other device is sharing the resource) to a different PCI/PCIe slot, or see if your motherboard's BIOS allows the resources to be reassigned manually.
- Try your audio interface with each possible connection (for example, in each possible PCI/PCIe slot, or attached to each possible firewire port, depending upon its connection type).
- Try temporarily disabling all network adapter devices, Bluetooth devices and wireless networking devices in Windows Device Manager (in the Windows Control Panel). Network/wireless devices/drivers are a common cause of audio performance problems.
- Keep any network leads and Internet connections disconnected while using the computer for audio. This prevents other Internet or 'auto updater' applications (such as Windows Update or virus scanner updaters) from updating while Hauptwerk is running, and potentially causing the network drivers to take processing time away from audio or from the audio interface's drivers.
- Disable Windows' disk indexing for all hard-drives (right-click on each drive icon, select *Properties*, then un-tick *Allow Indexing Service ...*, then select the option to apply to all sub-folders/files when prompted).
- Disable Windows Vista's scheduled hard-drive defragmentation (you will then instead need to defragment you hard-disk(s) manually periodically). To do so, right-click on each drive icon, select *Properties*, select the *Tools* tab, click *Defragment Now*, un-tick *Run on a schedule ...* and reboot.
- Try running the free DPCLAT utility available from Thesyscon to see if a hardware device/driver on your PC is introducing an excessive latency that is prevent your audio interface from being able to stream low-latency audio reliably. On a well-performing PC the latency values would normally be in the 50 - 200 microsecond range. Any values in excess of 1000 microseconds indicate a significant hardware/driver performance problem that is likely to cause audio glitches with 'pro audio' (low latency) audio applications such as Hauptwerk. If DPCLCAT shows a problem then you will need to identify the device that's causing the problem and probably either disable it (either in Windows Device Manager or in your motherboard's BIOS), or find a better-performing driver for it, or adjust its driver/BIOS settings.
- If your audio interface driver comes with audio/ASIO performance diagnostic utilities, then try using those in conjunction with their documentation to see if they can show where the problem is occurring. For example, the Echo Audiofire interfaces include a very useful 'ASIO Analyzer' utility which can quickly show whether there is a hardware/driver problem in the computer that's prevent the audio drivers from being able to work robustly for low-latency audio.
- If you're still having problems after trying all of the above suggestions, try sending a diagnostic file to your support provider (*File | Create a diagnostic file ...* in Hauptwerk) and detail the results of the preceding suggestions.
- If you have problems with occasional audio glitches on Windows Vista when the hard-disk indicator lamp shows unexpected activity, try disabling the Windows SuperFetch service, which has apparently caused erratic performance problems for some Hauptwerk users.

On both Mac OS X and Windows, we also recommend disabling any power saving modes, such as hibernation / sleeping, screen savers or hard-disk sleeping. On notebook computers this needs to be done only for the times when the mains power supply is connected (when conserving power would be less important anyway), and you should always have the mains power supply connected when using Hauptwerk. If the computer hibernates / sleeps, or enters a power-saving mode while Hauptwerk is running, then you might experience extreme performance issues, especially if the operating system needs to re-read all memory back from disk when waking.

No other operating system optimizations are usually needed on Apple Macs running OS X, since OS X has high-performance audio and MIDI support built-in and is usually already well-optimized for audio and MIDI.

Minimizing sample set loading times

Hauptwerk has an ultra-fast sample set loading mechanism that was introduced in version 3.10 and should load sample sets in a fraction of the time that was possible with any previous version. It is designed to take full advantage of multi-core computers and RAID arrays (RAID 1 or RAID 5 are probably best and safest).

The mechanism attempts to tune itself automatically for the number of CPU cores and the amount of free memory available. Fastest possible results should be achieved with computers that have four CPU cores (or more), two (or more) disks in a RAID array, and plenty of memory. However, loading should still be very fast even with older single-core computers.

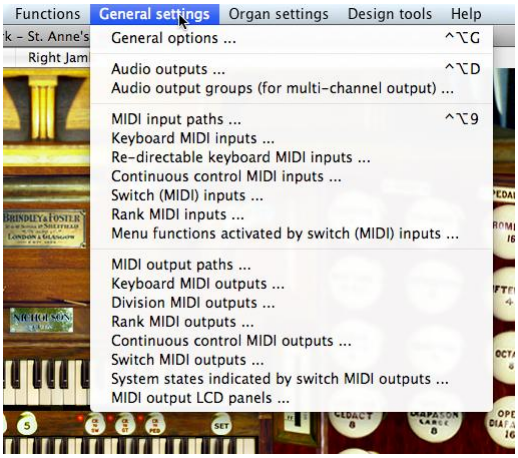
During the loading process, the mechanism needs to use some memory for buffering to try to get best possible performance from the disk drive(s) and processor(s). The mechanism is very carefully designed to minimize the amount of memory it needs at each point in time, and in many cases no more memory overall will be needed when loading a sample set. However, if minimizing memory usage in all circumstances is more important to you than minimizing loading times then you can disable the new mechanism completely using the *Disable sample set loading acceleration?* option on the *General settings | General options* screen.

Extensive performance and diagnostic information relating to the loading of each sample sets is written to the log file (*Help | View recent error/activity log*).

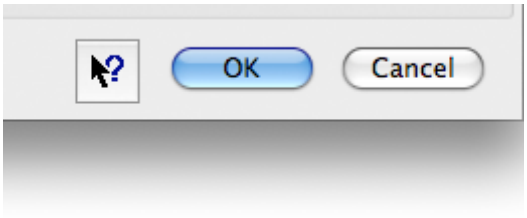
The first time that you load a sample set, or if you change its rank/memory options, the sample set will still be slow to load because Hauptwerk will need to regenerate its cached version of the sample set data. However, subsequent loads should then be extremely fast.

General options (global)

This section will give an overview of Hauptwerk's global configuration settings, accessible with the *General settings | General options* screen:



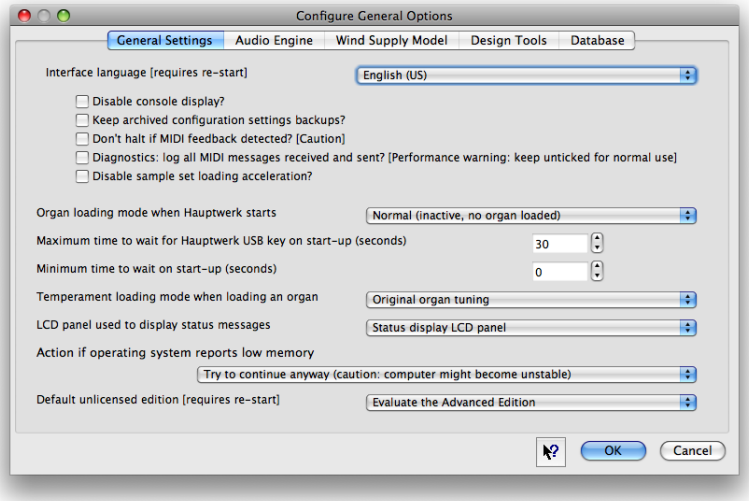
We will not describe all of the individual settings on those screens here, since comprehensive documentation is available for each setting and screen by clicking on the pointer/question-mark icon immediately to the left of a screen's *OK* button:



... then clicking onto the screen background or a specific setting for a detailed explanation of its function.

General Settings

The *General Settings* screen tab has various miscellaneous options:



The *Disable console display?* option prevents Hauptwerk from drawing the virtual console, which (only) very slightly saves processing resources. It should only be used when Hauptwerk is being controlled remotely from a MIDI organ console, and has been fully configured so that no access is required to the computer.

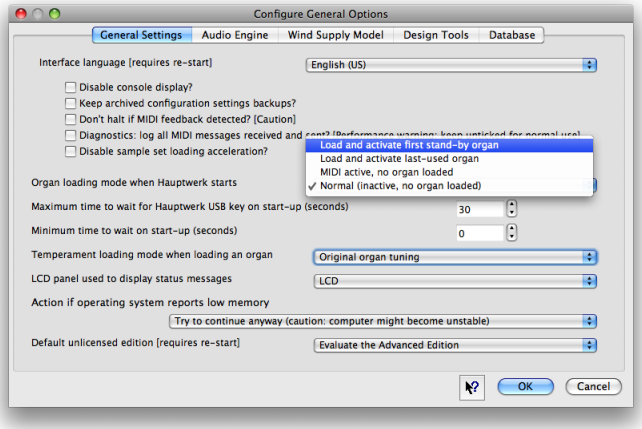
Backup configuration files automatically? makes Hauptwerk archive a copy of its settings each time they are saved, so that you can recover the settings to a given point in time later in an emergency. However, the archive files slow Hauptwerk down and consume disk space. Regardless of this setting Hauptwerk always maintains a single additional back-up copy of its settings, as covered in the troubleshooting section. Hence it is recommended that this setting be left turned off except in very special cases.

Whenever you load an organ or activate Hauptwerk's MIDI system, Hauptwerk automatically sends special MIDI messages to try to detect whether you have a virtual or physical MIDI lead connected between any of your selected MIDI OUT ports and MIDI IN ports. Having such a lead connected can crash or freeze Hauptwerk, the MIDI interface or your computer. If the *Don't halt if MIDI feedback detected?* option is not ticked (the default), Hauptwerk will deactivate the MIDI system immediately if it detects such a connection to avoid any instability resulting from MIDI feedback. However, this option is provided to allow you to disable that behavior if you have a MIDI organ console that has a MIDI implementation that does require such leads to be connected. Please only tick this option if you are absolutely certain that your MIDI console requires it, and if you are certain that your Hauptwerk configuration cannot cause any MIDI feedback with your MIDI hardware and wiring. **Beware: ticking this option might allow your computer to crash if your MIDI wiring or settings are incorrect.**

If you are unsure exactly what MIDI messages your MIDI hardware (such as a MIDI organ console, MIDI keyboard or MIDI expression pedal) is sending you can tick the *Diagnostics: log all MIDI messages received and sent?* option, load an organ, operate the controls on your MIDI hardware, and then look in Hauptwerk's log (*Help | View recent error/activity log*). The log will show you every MIDI message that Hauptwerk has received from your hardware in an easily-readable format, as well as every MIDI message that Hauptwerk has sent. You can then use this information to help you configure Hauptwerk's MIDI settings accordingly. CAUTION: when this option is ticked it will have a severe impact on Hauptwerk's performance (keys might be sluggish and you might get audio glitches), so you should turn MIDI logging off again as soon as you have determined the required information from the log. A performance warning to this effect will be displayed each time you load/activate an organ when MIDI logging is turned on.

Hauptwerk has an ultra high-speed sample set loading mechanism which attempts to tune itself automatically for the number of CPU cores and the amount of free memory available. During the loading process, the mechanism needs to use some memory for buffering to try to get best possible performance from your computer's hardware. The mechanism is very carefully designed to minimize the amount of memory it needs at each point in time, and in many cases no more memory overall will be needed when loading a sample set using the mechanism than with it disabled. However, if minimizing memory usage in all circumstances is more important to you than minimizing loading times then you can disable the mechanism completely using the *Disable sample set loading acceleration?* option.

Organ loading mode when Hauptwerk starts is primarily used when Hauptwerk is controlled remotely from a MIDI organ console, and is covered in the MIDI organ consoles section:



Temperament loading mode when loading an organ allows you to choose a default temperament for use with sample sets.

If Hauptwerk has previously been launched at least once with a Hauptwerk USB key attached to the computer, but the USB key is not found when you subsequently launch Hauptwerk, it will wait for the time specified by *Maximum time to wait for Hauptwerk USB key on start-up (seconds)* before starting in evaluation mode. This is mainly useful if you have Hauptwerk configured to start automatically when your computer starts, since the USB key might not have finished initializing when Hauptwerk is launched by the operating system. Set this to 0 if you wish to disable the delay entirely.

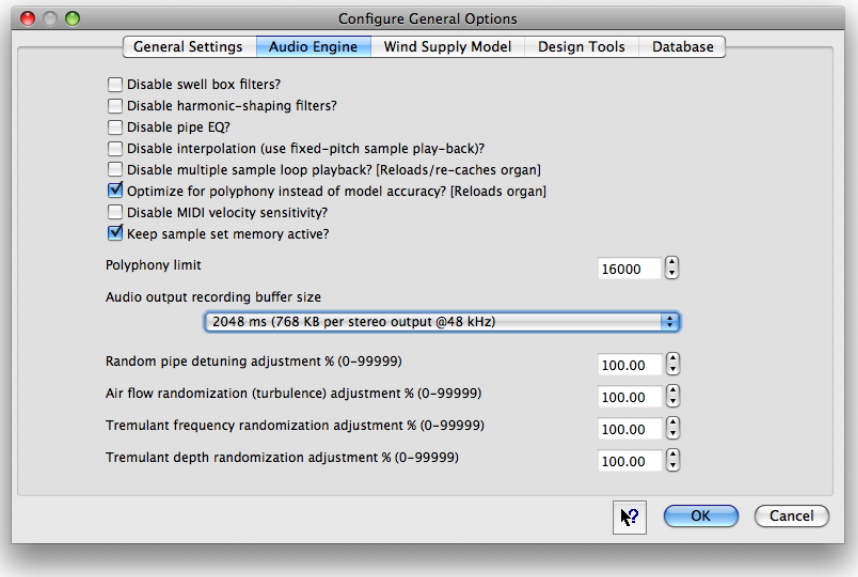
Whenever Hauptwerk is launched it will always wait for (at least) *Minimum time to wait on start-up (seconds)* before starting. This setting is useful if you have Hauptwerk configured to start automatically when your computer starts, but some of your MIDI or audio devices are slow to start and might not have finished initializing when Hauptwerk is launched by the operating system. In all other cases you should leave this set to 0, to avoid making Hauptwerk unnecessarily slow to launch.

The LCD status panel is covered in the MIDI output section, and is used to designate which, if any, of the LCD panels is to be used to show status information.

The *Action if operating system reports low memory* setting determines what Hauptwerk does if the operating system reports that free memory appears to be running very low while loading a sample set. Continuing to load in such circumstances gives a high risk of audio glitches and poor performance. In some cases (OS X Tiger, or on Windows if its page file is disabled, or if disk space is also used up) continuing can also give a significant risk of the operating system becoming unstable or the computer crashing or even corrupting your files, applications and data. If an error occurs the sample set data cache might also need to be regenerated. CAUTION: please do not select 'Try to continue anyway' unless you are an experienced computer user and understand and are prepared to accept the risks or have specifically been advised to select it by your support provider. The default action is to show a warning message and ask whether to continue loading.

When Hauptwerk starts, if a Hauptwerk USB key cannot be found, or if your USB key doesn't contain a valid license for the current version of Hauptwerk, then the *Default unlicensed edition* setting determines which edition will be started by default. For stand-alone and MIDI sequencing configurations you will also be prompted to choose the edition when Hauptwerk starts. However, for plug-in versions of Hauptwerk you must use this setting if you want to change the default unlicensed/evaluation edition, for example if you want to evaluate the VSTi Basic Edition of Hauptwerk. Because VST plug-ins cannot usually display options screens when they launch, to evaluate the Basic Edition for the VSTi version of Hauptwerk (for example), open Hauptwerk (by default it will start in Advanced Edition evaluation mode if no Hauptwerk USB key is found), go to the *General settings | General options* screen and change the *Default unlicensed edition* preference there for which edition to use/evaluate, then unload and re-load the plug-in to re-start Hauptwerk. You will then be able to use/evaluate the edition you selected.

Audio engine



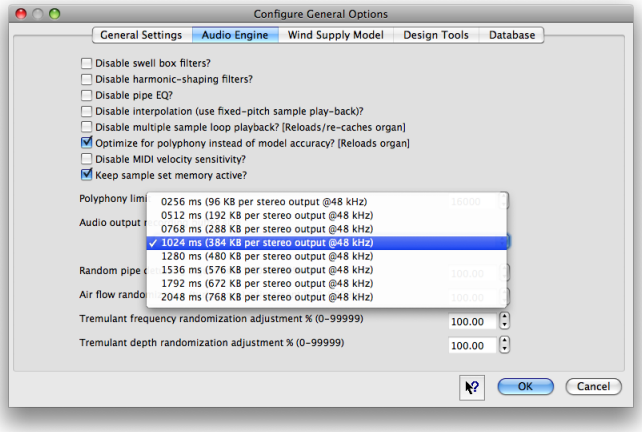
The Disable swell box filters?, Disable harmonic-shaping filters?, Disable pipe EQ?, Disable interpolation (use fixed-pitch sample playback)?, Disable multiple sample loop playback?, Optimize for polyphony instead of model accuracy?, Keep sample set memory active? and Polyphony limit settings are covered in the performance tuning section.

Disable MIDI velocity sensitivity effectively bypasses Hauptwerk's tracker-action model for sample sets which support it (St. Anne's does not) when velocity-sensitive MIDI keyboards are used. You should disable velocity sensitivity if your MIDI keyboards are not velocity-sensitive.

The remaining detuning and randomization adjustment settings allow aspects of Hauptwerk's physical models to be accentuated or suppressed.

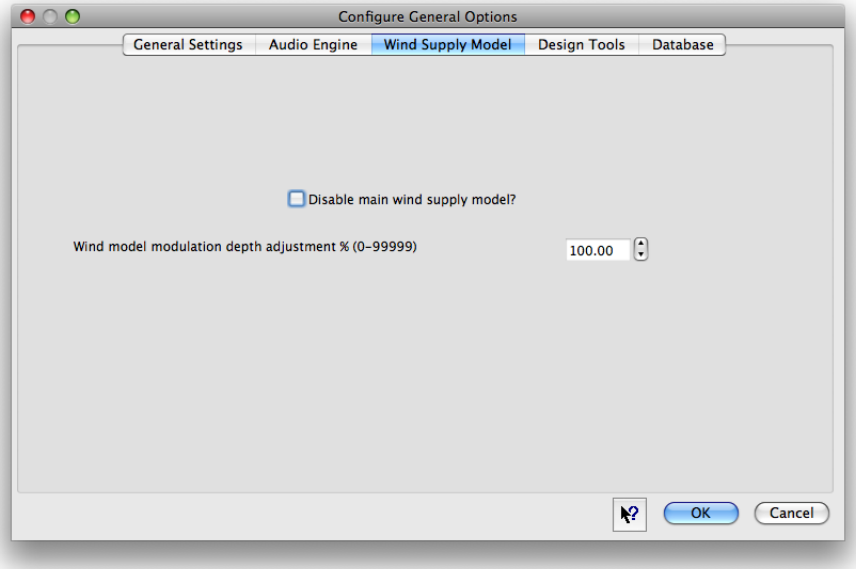
Many of these settings are duplicated for each sample set on the Organ settings | General options screen, accessible when a sample set is loaded, and in it is often best to adjust them there unless you wish to use these global settings to disable or suppress features entirely.

The Audio output recording buffer size setting can be used to prevent audio glitches in the sound you hear, or in the recorded output, when using Hauptwerk's built-in audio recording facility:



The setting determines the maximum amount of time Hauptwerk allows your hard-disk to write a chunk of streamed audio to disk before an audio glitch will be heard or recorded. The default setting should be fine for most modern hard-disks but if you have an old or slow disk or are recording a lot of audio outputs simultaneously then it might be necessary to increase this setting. Larger values use a little more memory.

Wind supply model



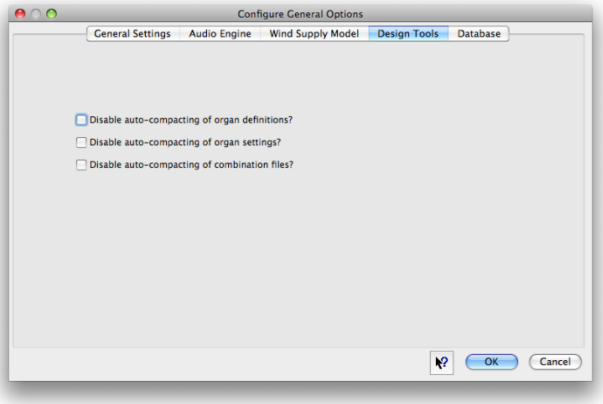
Hauptwerk's wind supply model uses fluid dynamics principles and equations to model the movements of air through a model of the wind supply system for an organ. The effects are to cause complex fluctuations and interactions in pipe speech and interactions between mechanical parts of the organ, such as its bellows, blower, regulators and so forth.

The model can be disabled entirely on this tab, or its overall affects emphasized or suppressed. If the model is disabled, then the needles on the *Wind* tab of the St. Anne's sample set will not move. The model can also be disabled individually for given sample sets using the *Organ settings | General options* screen.

Note that Hauptwerk's wind supply model, and this tab, are currently not available to customers in the U.S.A. and are only available in the Advanced Edition of Hauptwerk.

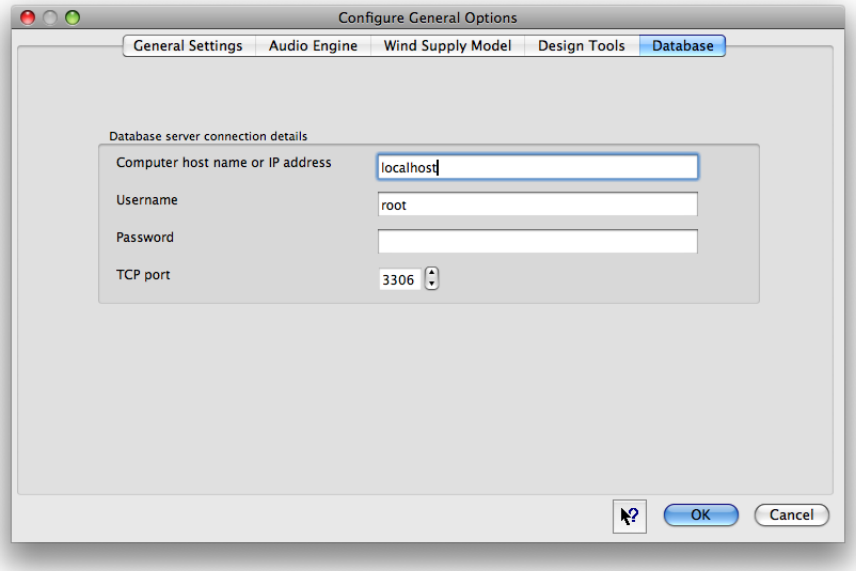
Design tools

Please see the design tools section for information on the options available on the *Design Tools* tab. The options on this screen should be left un-ticked for best performance:



Database

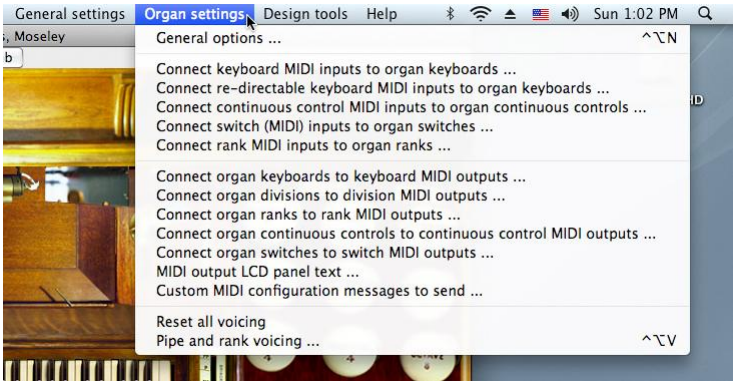
The *Database* tab is only available when the separate MySQL integration license option has been purchased, allowing you to alter the connection details to the MySQL Server:



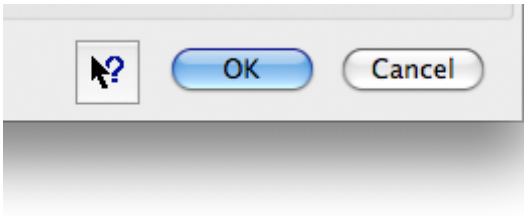
See the design tools section for more information.

Organ options (instrument specific)

This section will give an overview of Hauptwerk's global configuration settings stored specifically for each sample set, accessible with the *Organ settings | General options* screen when the sample set in question is loaded:



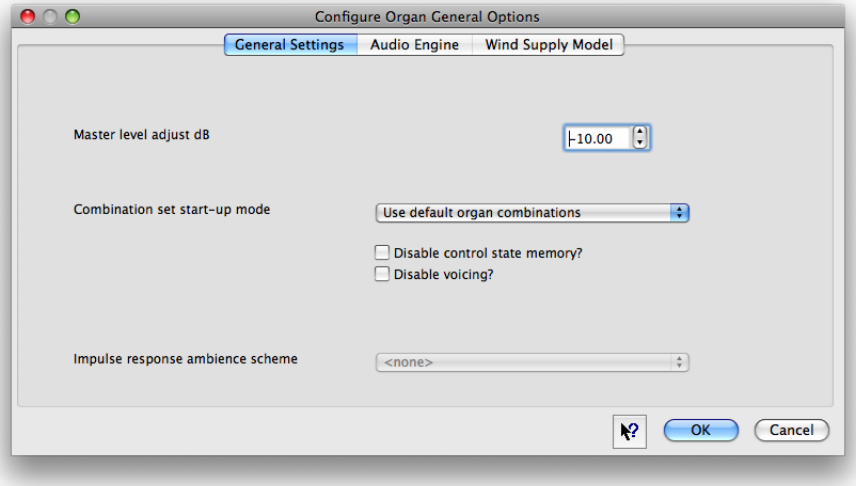
We will not describe all of the individual settings on those screens here, since comprehensive documentation is available for each setting and screen by clicking on the pointer/question-mark icon immediately to the left of a screen's *OK* button:



... then clicking onto the screen background or a specific setting for a detailed explanation of its function.

General settings

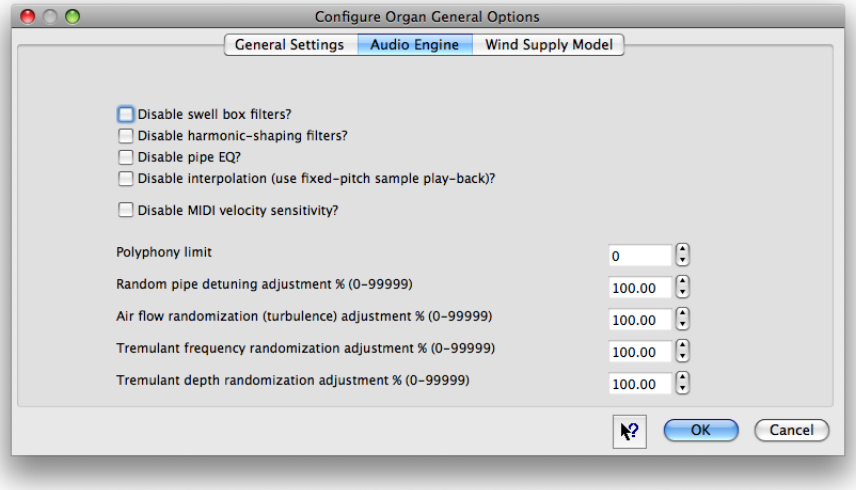
The *General Settings* screen tab has various miscellaneous options:



The level adjustment setting is especially important, allowing you to balance the output levels of sample sets if you use more than one. As covered in the performance tuning section, for best audio quality this level should be set as high as possible without *clipping* (audio distortion) occurring. The default value is deliberately set quite low to try to ensure that no clipping will occur by default, even if your audio interface's output level is set too high. In particular, some interfaces have a consumer/professional level setting, which could cause clipping if set incorrectly.

Combination set start-up mode allows you to specify a combination file which should be loaded automatically whenever the sample set is loaded.

Audio engine

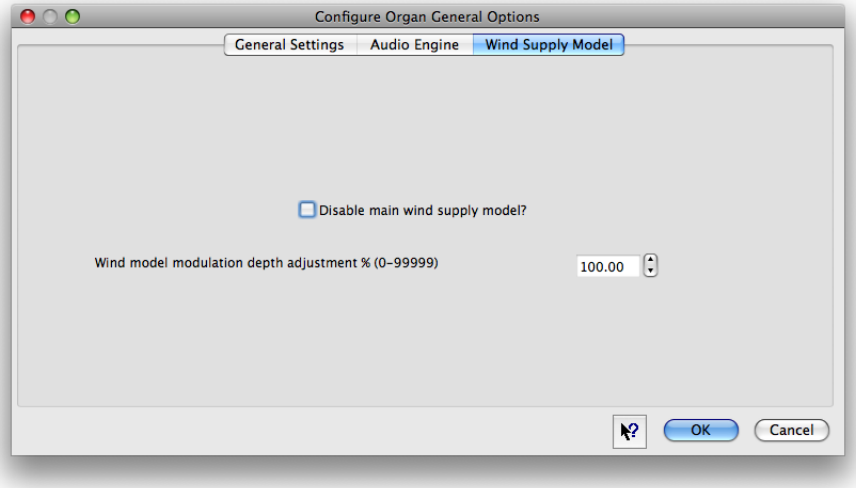


All of the options available here behave identically to their counterparts on the *General settings | General options* screen, and provide a means to override those global options individually for each sample set. If a feature is set to be disabled on either screen, then it will be disabled by Hauptwerk for the current sample set.

If the polyphony limit is set to zero then the global limit is used, whereas any non-zero values takes precedence over the global limit.

The detuning and randomization adjustment settings allow aspects of Hauptwerk's physical models to be accentuated or suppressed.

Wind supply model



Hauptwerk's wind supply model uses fluid dynamics principles and equations to model the movements of air through a model of the wind supply system for an organ. The effects are to cause complex fluctuations and interactions in pipe speech and interactions between mechanical parts of the organ, such as its bellows, blower, regulators and so forth.

The overall effects of the model can be emphasized or suppressed with this setting. The model can also be disabled entirely for the sample set, usually to reduce processing load.

Note that Hauptwerk's wind supply model, and this tab, are currently not available to customers in the U.S.A. and are only available in the Advanced Edition of Hauptwerk.

Voicing facilities

About voicing pipe organs

When a real pipe organ is installed it is necessary to make detailed adjustments to the sound of each pipe, a process termed voicing. Primarily this is because the acoustic of the room in which it is installed will respond differently to different frequencies, and depending on the position from which the sound is produced (the location of the pipe) and the position of the listener, as well as for aesthetic reasons.

For example, if a pipe with a fundamental frequency of 440 Hertz is placed at a point in the building that strongly amplifies that particular frequency (termed a node), then that pipe may sound much louder than its neighbors in the rank. The same applies to any of the frequencies (harmonics) present in the pipe sound, so the character of the sound can change very noticeably across the compass of a rank, due to the way that the room naturally accentuates and attenuates particular frequencies.

The pipe organ voicer needs to adjust the speech of each pipe so that these effects are minimized from the point of view of the listener.

The voicer also has the very important artistic role of adjusting the tonal qualities of the pipes so that all of the ranks sit well together, within the room acoustic, and produce the desired sound as a whole.

Voicing in Hauptwerk

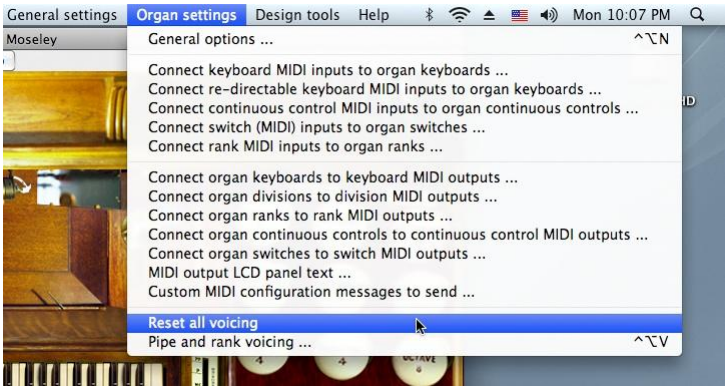
Most houses and domestic listening environments have relatively 'dead' acoustics, which color the sound only minimally. Likewise with headphones. Thus, when listening to an organ sample set that has been recorded 'wet' (including original acoustic) using Hauptwerk, often no adjustment to the sound of the sample set is necessary to be able to hear the instrument almost exactly as it sounds in its original environment.

However, if Hauptwerk is used in a reverberant space, or if 'dry' samples are used, then the ranks will usually benefit very significantly from being re-voiced to some degree, just as with a real pipe organ.

The Hauptwerk Advanced Edition has comprehensive per-pipe voicing facilities which allow different aspects of the sound of each pipe to be fine-tuned in real-time. These facilities are only available in the Hauptwerk Advanced Edition, so this section is only relevant for that edition.

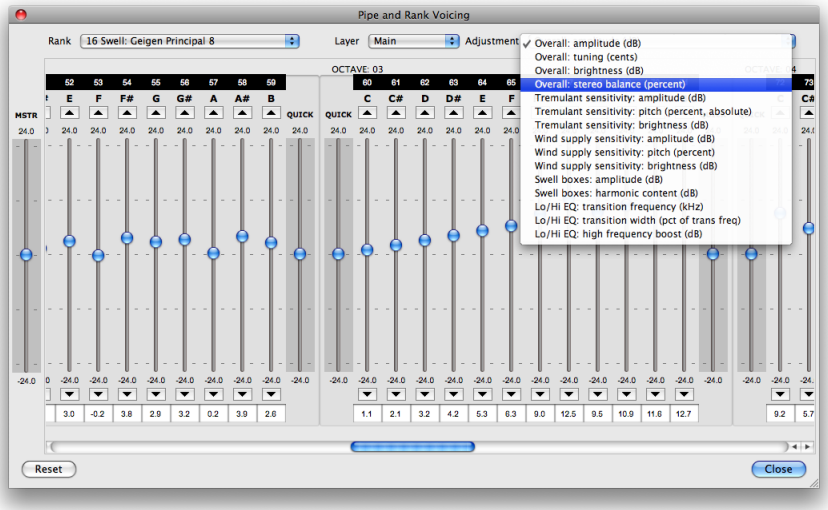
Using the voicing facilities

Hauptwerk stores voicing information separately for each organ. With a sample set loaded and active the voicing facilities are accessed by functions on the Organ settings menu:



Selecting the *Reset all voicing* restores all voicing stored for the organ to its default, and the sample set will then sound as it did when it was first installed, with any voicing changes you have made being wiped. If you select the option you will be prompted for confirmation.

The main pipe voicing screen is accessed from the *Pipe and rank voicing* menu option:



Before opening the screen, engage the stop for the rank you wish to voice, so that you can hear the effects of adjustments to its voicing. Then open the screen from the menu and select the rank you wish to adjust at the top-left of the screen. Only ranks that are loaded into memory are available. Note that you can also engage and disengage stops while the voicing screen is open.

Some sample sets use multiple layered samples for each pipe, although most do not. For multi-layer ranks, you can select the rank's layer that you wish to voice to the right of the rank selection.

Next select the particular aspect of the rank's sound that you want to adjust using the Adjustment setting. For example, select the 'Overall: amplitude (dB)' setting. Note that if you have disabled any of Hauptwerk's audio engine features using

either of the General settings | General options or Organ settings | General options screens then any adjustments that require those features will not appear in the list.

The bank of slider controls in the middle of the screen will move to show the amplitude value stored for each pipe in the rank. Initially all sliders will be at their default positions in the center of their travel since by default no voicing information will have been adjusted.
The pipes are identified within the rank by a unique note number at the top, and the octave number and key name is also shown for clarity. Middle C is always note number 60. The lowest C on a rank of 61-note compass is number 36, and the highest is 96. Some ranks have larger or smaller compasses, and each slider is only enabled if a pipe exists in the rank with that note number.

Press middle C and listen to its amplitude. Move the note 60 slider (middle C) up half way to the top of its travel and re-trigger the note. It should now sound about 12 decibels louder (about four times as loud). Note that some parameters require the note to be re-triggered to take effect, but most do not. You can use the up and down arrow buttons above and below the slider to fine-tune the position of the slider, or type a value directly (to one decimal place) in the text box below it.

Drag the slider to the left of the octave marked *QUICK* downwards. You will see it move all sliders for the octave, incrementing their positions proportionally to how close they are to the slider. When you let go of the slider it will spring back to its center position, but the individual pipe sliders will remain where they were are. The *QUICK* slider to the right of the octave behaves in the same way, with the right-hand end of the octave being affected most strongly. Together, these special sliders allow the response of a rank as a whole to be shaped very quickly. Often it is best to use these to shape the rank's response roughly at first, then fine-tune each pipe using its dedicated slider.

To the far left of the screen is a slider labeled *MSTR* (short for *master*). This slider works in the same way as the *QUICK* sliders, but moves *all* of the note sliders equally for the whole rank, rather than just affecting one octave. This slider is a very convenient tool for initial adjustment of the basic sound of each rank, and the organ as a whole, prior to fine-tuning the parameters at the octave or individual pipe levels with the other sliders.

Provided that the associated audio engine features are enabled, the following real-time adjustments are available for each pipe (and layer):

- Overall: amplitude (dB).
- Overall: tuning (cents).
- Overall: brightness (dB).
- Overall: stereo balance (percent).
- Tremulant sensitivity: amplitude (dB).
- Tremulant sensitivity: pitch (percent, absolute).
- Tremulant sensitivity: brightness (dB).
- Wind supply sensitivity: amplitude (dB).
- Wind supply sensitivity: pitch (percent).
- Wind supply sensitivity: brightness (dB).
- Swell boxes: amplitude (dB).
- Swell boxes: harmonic content (dB).
- Lo/Hi EQ: transition frequency (kHz).
- Lo/Hi EQ: transition width (pct of trans freq).
- Lo/Hi EQ: high frequency boost (dB).

For all of the adjustments calibrated in decibels (dB) the slider specifies a value *relative to the pipe's default value*. For example, if you adjust the 'Tremulant sensitivity: brightness (decibels)' value to -6, then the depth of the brightness modulation that Hauptwerk applies to the pipe will be about half of the value specified by the sample set's creator (-6 dB

equates approximately to a halving in absolute value). For percentage values, 100 percent represents the default value specified by the sample set's creator.

The stereo balance only has an effect if the rank is routed to a stereo audio output (that is, if the channel format is stereo on *General settings | Audio outputs*). A stereo balance of -100 percent means that the left channel will be heard at twice its normal amplitude, and the right channel will not be heard at all. +100 percent is the opposite, and the default value of 0 percent means that the two stereo channels will be heard at the default amplitudes defined by the creator of the sample set you are using.

Of course, for tremulant sensitivity adjustments to be audible, you must also have the relevant tremulant engaged, if any. Likewise, swell parameters have no effect if the rank is not enclosed in a swell box.

The *Lo/Hi EQ* adjustments allow you to apply a simple low-pass or high-pass parametric EQ (filter) to the pipe, adjusting its balance between bass and treble. The transition frequency specifies the center-point between the bass and treble bands. The transition width determines the steepness of the frequency response curve in the transition region between the bass and treble, and is specified as a percentage of the transition frequency. Generally it is best to avoid very low values for the transition width, since they will give a very steep frequency response and higher 'filter ripple' (an effect where the frequencies either side of the transition are boosted or attenuated excessively in a narrow band, compared to the rest of the frequency response). Equivalent parameters can be specified within the virtual organ by its creator of the organ, and the default values for the EQ parameters are taken from the virtual organ definition. Any adjustments to these EQ parameters override those specified by the organ's creator.

Finally, note that some sample sets are intended only to be heard exactly as they were recorded and have licenses which explicitly disallow any voicing adjustments. For such sample sets the voicing menu functions are not enabled.

Section VI: Reference

MIDI implementation

The MIDI input and MIDI output sections describe how MIDI input and output are configured generally.

This section is intended to provide additional reference for those building, buying or converting MIDI organ consoles for use with Hauptwerk. Please also consult the MIDI organ consoles section for suggestions and further information.

Hauptwerk's MIDI system is extremely flexible, designed to be compatible with almost all of the many diverse types of MIDI digital organs in existence, and any scheme by which an organ console may have been wired for MIDI. The MIDI implementation is also backwardly compatible with systems built for Hauptwerk version 1.

MIDI output is only available in the Advanced Edition of Hauptwerk, so the sections and references below that relate to MIDI output are not relevant for the smaller Hauptwerk Basic Edition.

Keyboards

Hauptwerk's virtual keyboards (manuals and pedalboards) respond to MIDI note-on/off messages with no restriction on MIDI port and MIDI channel for a keyboard as a whole. Theatre organ after-touch can be triggered by either:

- A second set of key contacts, sending MIDI note-on/off messages on a separate MIDI port or channel (the ideal method).
- Keys being played on a standard MIDI keyboard when their note-on velocity exceeds a specified threshold. Hauptwerk will release the virtual after-touch keys when the keyboard keys are released.
- Keys being played on a standard MIDI keyboard when their polyphonic after-touch (pressure) exceeds a specified threshold. Hauptwerk will release the virtual after-touch keys when their pressure falls below the threshold.

Some sample sets are able to respond to key velocity. Hauptwerk provides a tracker action model which enables key velocity to be used to adjust the initial speech of pipes, where it is included in a sample set. However, velocity-sensitive keyboards are not a requirement.

Hauptwerk can produce MIDI output from virtual keyboards using standard note-on/off messages, again with no restriction on MIDI port or channel for a keyboard as a whole. Key on and off velocity is sent, but no after-touch.

Keyboard inputs and outputs are connected before key-action coupling.

Rank and division inputs and outputs

Hauptwerk's virtual ranks (but not divisions) can respond to MIDI note-on/off messages directly, with no restriction on MIDI port and MIDI channel for a rank as a whole. It can produce MIDI output from virtual ranks or divisions using standard note-on/off messages, again with no restriction on MIDI port or channel for a rank or division as a whole. Key on and off velocity is sent, but no after-touch.

Division outputs are post-coupling, i.e. may be affected by any virtual couplers engaged.

Rank inputs and outputs relate to single virtual ranks only, and are also post-coupling.

Rank input is entirely optional, and provides an alternative to input at the keyboard level. Unless Hauptwerk is to be used as a voice expander, the keyboard level would be the normal choice.

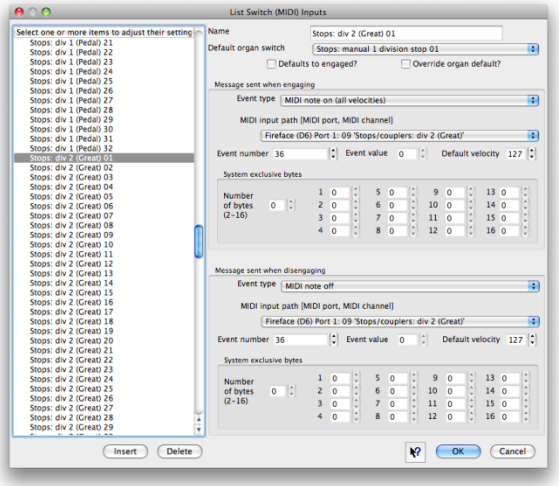
Switches

Hauptwerk's virtual switch inputs can be turned on or off by any of the following types of events, and the engaging and disengaging event types need have no relationship to each other. For example, if an engaging event was a MIDI note-on message, then it would be usual (and recommended) for the disengaging event to be a note-off message, but that is not strictly a requirement; the disengaging event could instead be a program change if preferred. Any message type and MIDI input path can be used for either, with no restrictions.*(*)* The event types are:

- MIDI note-on.
- MIDI note-on with a velocity exceeding a specified threshold.
- MIDI note-on with a velocity below a specified threshold.
- MIDI note-off.
- MIDI program change.
- MIDI control change, controller value ignored.
- MIDI control change with specific controller value.
- MIDI control change with controller value exceeding a specified threshold.
- MIDI control change with controller value below a specified threshold.
- MIDI note polyphonic after-touch exceeding a specified threshold.
- MIDI note polyphonic after-touch below a specified threshold.
- Computer keyboard key pressed.
- Computer keyboard key released.
- MIDI system exclusive (up to 16 bytes in total).
- MIDI RPN, controller value ignored.
- MIDI RPN with specific controller value.
- MIDI RPN with controller value exceeding a specified threshold.
- MIDI RPN with controller value below a specified threshold.
- MIDI NRPN, controller value ignored.
- MIDI NRPN with specific controller value.
- MIDI NRPN with controller value exceeding a specified threshold.
- MIDI NRPN with controller value below a specified threshold.
- None (engaging event toggles/pulses organ switch).

If your MIDI switch (or computer key) sends a message only as you press it down, and not when it is released, as is usual for push-buttons/pistons, then set the disengaging event type to 'none'. Hauptwerk will then automatically toggle the state of any connected virtual organ switch if it is a 'latching' switch such as a drawknob or tab, or briefly pulse its state on if the virtual organ switch is a 'momentary' piston.

For MIDI event types, any MIDI port and channel can be used for the engaging and disengaging events, hence there are almost no restrictions on message type, port or channel for any switch. Hardware switches are listed in Hauptwerk with the *General settings | Switch (MIDI) inputs* screen:



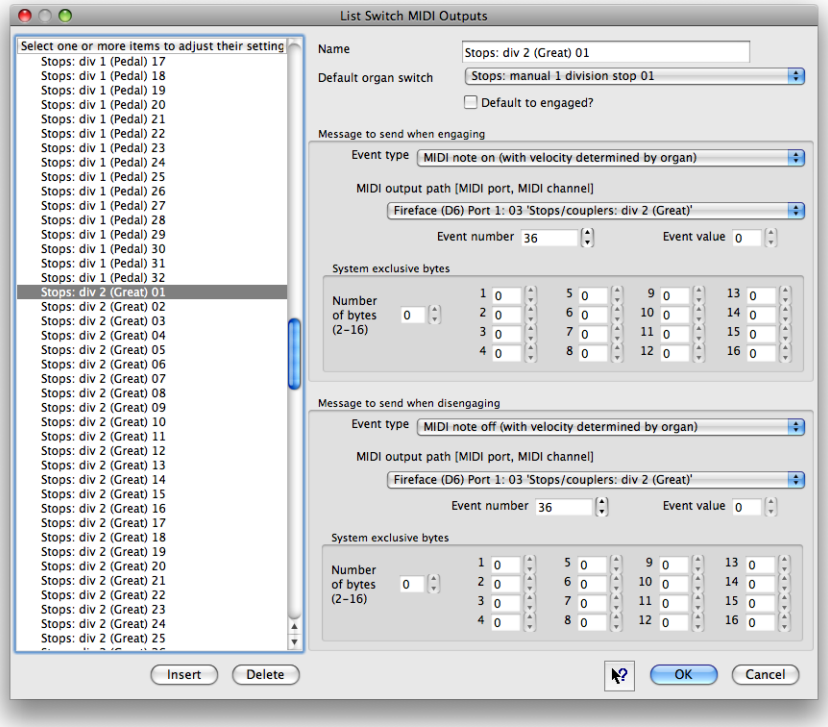
Any configured switch input can be used to control any of Hauptwerk's switches, including, for example:

- Virtual stops.
- Virtual couplers.
- Virtual tremulants.
- Virtual pistons.
- Any other virtual switches in a sample set.
- Hauptwerk's menu functions.

Hauptwerk's virtual switch outputs can produce any of the following types of events, and again the engaging and disengaging event types need have not necessarily have any relationship to each other (although it is recommended that they do).

- MIDI note-on with a fixed specified velocity.
- MIDI note-on with the velocity of the virtual switch.
- MIDI note-off with a fixed specified velocity.
- MIDI note-off with the velocity of the virtual switch.
- MIDI program change.
- MIDI control change.
- MIDI system exclusive (up to 16 bytes in total).
- MIDI RPN.
- MIDI NRPN.
- None (indicates that no message is sent to the hardware).

As for input events, any MIDI port and channel can be used for the engaging and disengaging events, hence there are almost no restrictions on message type, port or channel for any switch. Hardware switches are listed in Hauptwerk with the *General settings | Switch MIDI outputs* screen:



Hauptwerk can send such switch output events from any of its logical switches, such as:

- Virtual stops.
- Virtual couplers.
- Virtual tremulants.
- Virtual pistons.
- Any other virtual switches in a sample set.
- Hauptwerk system states (such as whether Hauptwerk is active).

Although you are free to use any of the event types described above, if you are wiring a new console, for simplicity and consistency our recommendations would be:

- For MIDI switches which change state physically, such as solenoid-actuated/illuminated draw-knobs or tabs, use MIDI note-on/off messages for both input and output.
- Similarly control indicator lamps from Hauptwerk with note-on/off messages.
- For momentary push-buttons, such as non-latching pistons, send MIDI program change messages to Hauptwerk.
- For the capture/setter piston, use a momentary push-button which sends a MIDI note-on message as it is pressed in, and a MIDI note-off message as it springs back out, so that it must physically be held in while in capture mode, thus preventing accidental erasure of combinations or menu stand-by assignments.

For ease of diagnosing problems and wiring we would also recommend using the same MIDI port and channel and, where applicable, note number, for both engaging and disengaging events for a given MIDI switch or indicator lamp.

Please see the appendix below for a list of computer key codes recognized for switch (MIDI) input computer key events.

(*) Note that engaging and disengaging MIDI messages cannot be identical for a given MIDI switch unless you want Hauptwerk to toggle/pulse the state of any connected organ switch in response to such a message, in which case please simply select 'None (engaging event toggles/pulses)' for the disengaging event type setting.

Continuous controllers

Hauptwerk's virtual continuous controls are used to represent swell pedals, crescendo pedals and any other entities that may take one of a continuous range of values, such as the extension of a bellows.

Virtual continuous controls can be controlled by MIDI control change messages. Any MIDI port, channel and controller number can be used for any virtual control. Likewise a virtual control can send MIDI control change messages to indicate its position using any desired MIDI port, channel and controller number. The only restriction is that only MIDI control change messages can be used.

LCD panel system

Hauptwerk is able to control 32-character LCD panels using custom MIDI system exclusive messages to show labels specific to the sample set loaded. Usually this would be used to show stop, coupler, piston and other control names next to MIDI draw-knobs/tabs on an organ console so that their function is clear when multiple sample sets are used. However, one LCD panel can also be designated as a status display panel, upon which Hauptwerk will display a summary of the information shown in its main window title and status bar, along with an indication of whether an error has occurred.

Each panel can be controlled from any MIDI output port with no restrictions. Full details of the LCD panel system, including the format of the custom system exclusive messages, are given in the MIDI output section.

Custom MIDI output messages

Custom MIDI output messages can optionally be sent from Hauptwerk whenever it is activated and/or deactivated. These messages can each be sent to any MIDI port without restriction, and are specified as a sequence of up to 16 raw MIDI bytes so that any custom type of message that may be required by your hardware can be sent, including system exclusive messages.

Again, full details are given in the MIDI output section.

Miscellaneous MIDI port/channel restrictions

As covered above, there are no formal restrictions on MIDI ports or channels for any of the supported types of communication. However, please note that the *Transposer affects this path?* setting on the *General settings | MIDI input paths* screen is used to prevent the transposer affecting MIDI input paths which are used for switch MIDI inputs. Note that for this reason, you may prefer not to mix MIDI keys and MIDI control switches on a single MIDI encoder, where the setting would affect all note-on/off messages on the MIDI channel.

Menu functions

Except for functions which require user input, all of the functions on the *File*, *Organ*, *Combinations*, *Temperament* and *Functions* menus can be triggered by MIDI. Any input switch (as above) can trigger any one of the functions.

System state output

The following Hauptwerk system states can be used to control external indicator lamps or other indicator devices via any output switch (see above):

- MIDI system ready.
- Sample set loaded.
- Sample set loading.
- Error.
- Audio output recording in progress.
- Capture mode (combination setter) active.
- Re-directable input 1 route 1 active.
- Re-directable input 1 route 2 active.
- Re-directable input 1 route 3 active.
- Re-directable input 1 route 4 active.
- Re-directable input 2 route 1 active.
- Re-directable input 2 route 2 active.
- Re-directable input 2 route 3 active.
- Re-directable input 2 route 4 active.

Appendix: computer key codes

The following key codes can be used for 'Computer keyboard key pressed/released' event types for the *General settings | Switch (MIDI) inputs* screen:

Escape	16777216
Tab	16777217
Backtab	16777218
Backspace	16777219
Return	16777220
Enter	16777221
Insert	16777222
Delete	16777223
Pause	16777224
Print	16777225
SysReq	16777226
Clear	16777227
Home	16777232
End	16777233
Left	16777234
Up	16777235
Right	16777236
Down	16777237
PageUp	16777238
PageDown	16777239
Shift	16777248
Control	16777249
Meta	16777250
Alt	16777251
CapsLock	16777252
NumLock	16777253
ScrollLock	16777254
F1	16777264
F2	16777265
F3	16777266
F4	16777267
F5	16777268
F6	16777269
F7	16777270
F8	16777271
F9	16777272
F10	16777273
F11	16777274
F12	16777275
F13	16777276
F14	16777277
F15	16777278
F16	16777279
F17	16777280

F18	16777281
F19	16777282
F20	16777283
F21	16777284
F22	16777285
F23	16777286
F24	16777287
F25	16777288
F26	16777289
F27	16777290
F28	16777291
F29	16777292
F30	16777293
F31	16777294
F32	16777295
F33	16777296
F34	16777297
F35	16777298
Extra: Super_L	16777299
Extra: Super_R	16777300
Extra: Menu	16777301
Extra: Hyper_L	16777302
Extra: Hyper_R	16777303
Extra: Help	16777304
Extra: Direction_L	16777305
Extra: Direction_R	16777312
ANSI: Space	32
ANSI: Exclam	33
ANSI: QuoteDbl	34
ANSI: NumberSign	35
ANSI: Dollar	36
ANSI: Percent	37
ANSI: Ampersand	38
ANSI: Apostrophe	39
ANSI: ParenLeft	40
ANSI: ParenRight	41
ANSI: Asterisk	42
ANSI: Plus	43
ANSI: Comma	44
ANSI: Minus	45
ANSI: Period	46
ANSI: Slash	47
ANSI: 0	48
ANSI: 1	49
ANSI: 2	50
ANSI: 3	51
ANSI: 4	52
ANSI: 5	53
ANSI: 6	54

ANSI: 7	55
ANSI: 8	56
ANSI: 9	57
ANSI: Colon	58
ANSI: Semicolon	59
ANSI: Less	60
ANSI: Equal	61
ANSI: Greater	62
ANSI: Question	63
ANSI: At	64
ANSI: A	65
ANSI: B	66
ANSI: C	67
ANSI: D	68
ANSI: E	69
ANSI: F	70
ANSI: G	71
ANSI: H	72
ANSI: I	73
ANSI: J	74
ANSI: K	75
ANSI: L	76
ANSI: M	77
ANSI: N	78
ANSI: O	79
ANSI: P	80
ANSI: Q	81
ANSI: R	82
ANSI: S	83
ANSI: T	84
ANSI: U	85
ANSI: V	86
ANSI: W	87
ANSI: X	88
ANSI: Y	89
ANSI: Z	90
ANSI: BracketLeft	91
ANSI: Backslash	92
ANSI: BracketRight	93
ANSI: AsciiCircum	94
ANSI: Underscore	95
ANSI: QuoteLeft	96
ANSI: BraceLeft	123
ANSI: Bar	124
ANSI: BraceRight	125
ANSI: AsciiTilde	126
Latin1: nobreakspace	160
Latin1: exclamdown	161
Latin1: cent	162

Latin1: sterling	163
Latin1: currency	164
Latin1: yen	165
Latin1: brokenbar	166
Latin1: section	167
Latin1: diaeresis	168
Latin1: copyright	169
Latin1: ordfeminine	170
Latin1: guillemotleft	171
Latin1: notsign	172
Latin1: hyphen	173
Latin1: registered	174
Latin1: macron	175
Latin1: degree	176
Latin1: plusminus	177
Latin1: twosuperior	178
Latin1: threesuperior	179
Latin1: acute	180
Latin1: mu	181
Latin1: paragraph	182
Latin1: periodcentered	183
Latin1: cedilla	184
Latin1: onesuperior	185
Latin1: masculine	186
Latin1: guillemotright	187
Latin1: onequarter	188
Latin1: onehalf	189
Latin1: threequarters	190
Latin1: questiondown	191
Latin1: Agrave	192
Latin1: Aacute	193
Latin1: Acircumflex	194
Latin1: Atilde	195
Latin1: Adiaeresis	196
Latin1: Aring	197
Latin1: AE	198
Latin1: Ccedilla	199
Latin1: Egrave	200
Latin1: Eacute	201
Latin1: Ecircumflex	202
Latin1: Ediaeresis	203
Latin1: Igrave	204
Latin1: Iacute	205
Latin1: Icircumflex	206
Latin1: Idiaeresis	207
Latin1: ETH	208
Latin1: Ntilde	209
Latin1: Ograve	210
Latin1: Oacute	211

Latin1: Ocircumflex	212
Latin1: Otilde	213
Latin1: Odiaeresis	214
Latin1: multiply	215
Latin1: Ooblique	216
Latin1: Ugrave	217
Latin1: Uacute	218
Latin1: Ucircumflex	219
Latin1: Udiaeresis	220
Latin1: Yacute	221
Latin1: THORN	222
Latin1: ssharp	223
Latin1: division	247
Latin1: ydiaeresis	255
Multi-key: AltGr	16781571
Multi-key: Multi_key	16781600
Multi-key: Codeinput	16781623
Multi-key: SingleCandidate	16781628
Multi-key: MultipleCandidate	16781629
Multi-key: PreviousCandidate	16781630
Chararcter set mode switch	16781694
Japanese: Kanji	16781601
Japanese: Muhenkan	16781602
Japanese: Henkan	16781603
Japanese: Romaji	16781604
Japanese: Hiragana	16781605
Japanese: Katakana	16781606
Japanese: Hiragana_Katakana	16781607
Japanese: Zenkaku	16781608
Japanese: Hankaku	16781609
Japanese: Zenkaku_Hankaku	16781610
Japanese: Touroku	16781611
Japanese: Massyo	16781612
Japanese: Kana_Lock	16781613
Japanese: Kana_Shift	16781614
Japanese: Eisu_Shift	16781615
Japanese: Eisu_toggle	16781616
Korean: Hangul	16781617
Korean: Hangul_Start	16781618
Korean: Hangul_End	16781619
Korean: Hangul_Hanja	16781620
Korean: Hangul_Jamo	16781621
Korean: Hangul_Romaja	16781622
Korean: Hangul_Jeonja	16781624
Korean: Hangul_Banja	16781625
Korean: Hangul_PreHanja	16781626
Korean: Hangul_PostHanja	16781627
Korean: Hangul_Special	16781631
Multimedia: Back	16777313

Multimedia: Forward	16777314
Multimedia: Stop	16777315
Multimedia: Refresh	16777316
Multimedia: VolumeDown	16777328
Multimedia: VolumeMute	16777329
Multimedia: VolumeUp	16777330
Multimedia: BassBoost	16777331
Multimedia: BassUp	16777332
Multimedia: BassDown	16777333
Multimedia: TrebleUp	16777334
Multimedia: TrebleDown	16777335
Multimedia: MediaPlay	16777344
Multimedia: MediaStop	16777345
Multimedia: MediaPrevious	16777346
Multimedia: MediaNext	16777347
Multimedia: MediaRecord	16777348
Multimedia: HomePage	16777360
Multimedia: Favorites	16777361
Multimedia: Search	16777362
Multimedia: Standby	16777363
Multimedia: OpenUrl	16777364
Multimedia: LaunchMail	16777376
Multimedia: LaunchMedia	16777377
Multimedia: Launch0	16777378
Multimedia: Launch1	16777379
Multimedia: Launch2	16777380
Multimedia: Launch3	16777381
Multimedia: Launch4	16777382
Multimedia: Launch5	16777383
Multimedia: Launch6	16777384
Multimedia: Launch7	16777385
Multimedia: Launch8	16777386
Multimedia: Launch9	16777387
Multimedia: LaunchA	16777388
Multimedia: LaunchB	16777389
Multimedia: LaunchC	16777390
Multimedia: LaunchD	16777391
Multimedia: LaunchE	16777392
Multimedia: LaunchF	16777393
Multimedia: MediaLast	16842751
Keypad navigation: Select	16842752
Keypad navigation: Yes	16842753
Keypad navigation: No	16842754
Newer misc: Cancel	16908289
Newer misc: Printer	16908290
Newer misc: Execute	16908291
Newer misc: Sleep	16908292
Newer misc: Play	16908293
Newer misc: Zoom	16908294

Device keys: Context1	17825792
Device keys: Context2	17825793
Device keys: Context3	17825794
Device keys: Context4	17825795
Device keys: Call	17825796
Device keys: Hangup	17825797
Device keys: Flip	17825798
Dead: Grave	16781904
Dead: Acute	16781905
Dead: Circumflex	16781906
Dead: Tilde	16781907
Dead: Macron	16781908
Dead: Breve	16781909
Dead: Abovedot	16781910
Dead: Diaeresis	16781911
Dead: Abovering	16781912
Dead: Doubleacute	16781913
Dead: Caron	16781914
Dead: Cedilla	16781915
Dead: Ogonek	16781916
Dead: Iota	16781917
Dead: Voiced_Sound	16781918
Dead: Semivoiced_Sound	16781919
Dead: Belowdot	16781920
Dead: Hook	16781921
Dead: Horn	16781922
[Unknown key]	33554431

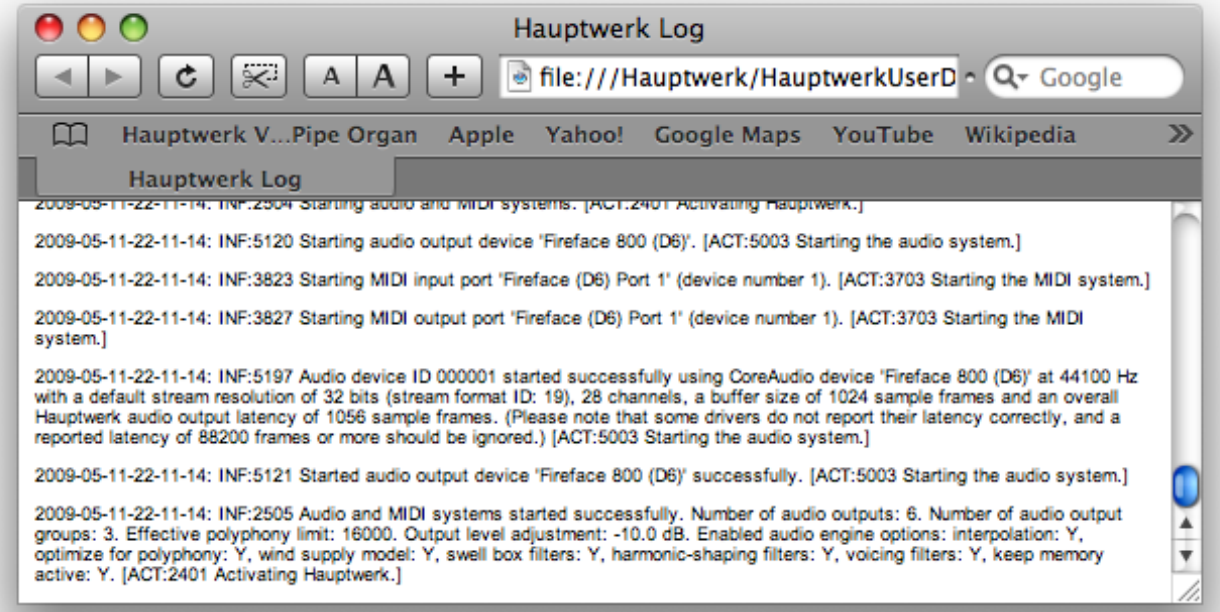
Troubleshooting

Errors, warnings and the log file

If Hauptwerk encounters a problem, an error or warning message will be displayed on the screen. Each message has a unique code, shown below the message. If you need to contact your support provider for support, this code helps him or her to locate its cause.

All errors, warnings and information messages shown on the screen are also written to a log file so that you can refer back to them later, and so that they can easily and accurately be sent to your support provider if you need assistance. To view the log file select *Help* | *View recent error/activity log* from the Hauptwerk menu:

... and then scroll to the end of the log:



Note that additional diagnostic information is sometimes written to the log file, which you may wish to examine on occasions. For example, the total audio latency is recorded, along with timing information when loading sample sets, and some errors that are not critical and could interrupt the audio output if reported on the screen, such as failures to send MIDI system exclusive messages. Hence it is worth checking the log file periodically.

What to do if an error occurs

First of all, make absolutely certain that you have carefully read the message displayed by Hauptwerk. Usually the message will contain all of the information necessary to fix the problem. If you wish to refer back to the messages, use *Help | View recent error/activity log* and scroll to the end of the log.

Please also make sure that you have read all of this user guide and at least the FAQ section on the Hauptwerk website before contacting your support provider for support. If you are having problems with a setting on one of the settings screens, make sure that you have tried clicking on the pointer/question-mark icon immediately to the left of a screen's *OK* button, then clicking onto the setting to see if the on-line help gives you the necessary information. Most of the on-line help is not duplicated in this user guide.

Also make sure that you have all current operating and driver updates applied, and especially that you have the latest drivers installed for your audio/MIDI interface(s).

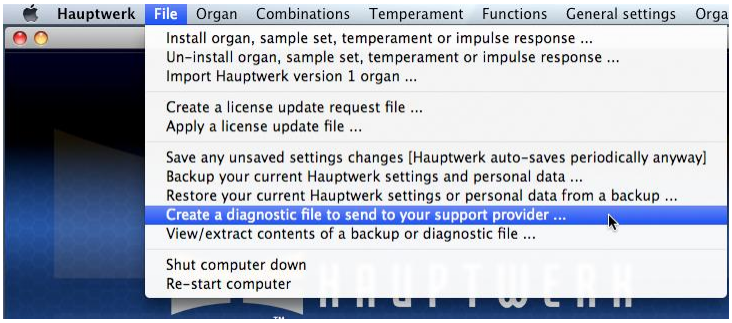
If you still do not know how to solve the problem, provided that you are on a supported Hauptwerk version and are within the support period for that version, you can of course contact your support provider for support. Please initially contact the vendor from whom you bought Hauptwerk, who will advise you who to contact. If you purchased a license for Hauptwerk directly from Milan Digital Audio then please see the Hauptwerk website to contact us. You can also try posting details of your problem to our on-line forum if you do not need a solution urgently.

Important: If you do need to contact your support provider about a problem, please always try to **describe the problem as accurately and concisely as possible** in an email **and** then use the instructions in the following section to **send a diagnostic file** attached to the email. That will allow him or her to see your log file, your main Hauptwerk settings and various other Hauptwerk settings and files that are essential for diagnosing most problems quickly and easily.

How to send a diagnostic file

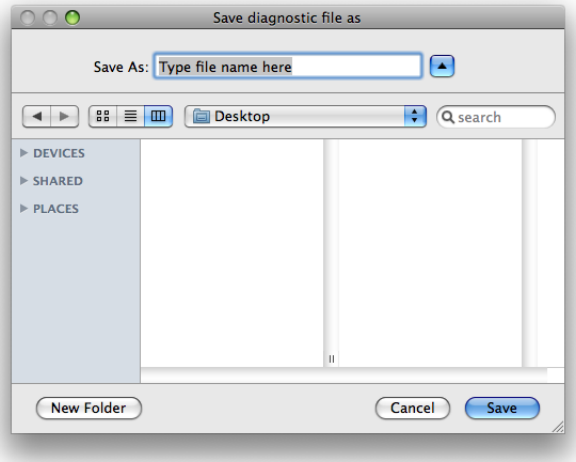
Step 1. If the problem you are having relates to a specific sample set, then please first make sure that the sample set is loaded (unless that's impossible). When you create a diagnostic file in the next step Hauptwerk will then include settings that relate to that sample set.

Step 2. Select *File | Create a diagnostic file to send to your support provider* from the Hauptwerk menu:

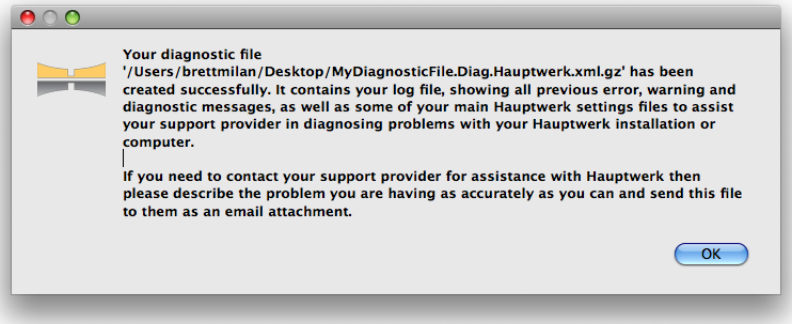


A button to create a diagnostic file is also provided on the message window when Hauptwerk displays an error message. Clicking that button has the same effect as using the *File | Create a diagnostic file to send to your support provider* menu function.

Step 3. A *Save as* window will appear. Use it to navigate to a location in which you want the file to be created. For example, choose your desktop or your home folder (Mac OS X) or My Documents folder (Windows). Type a meaningful name for the file, so that you will be able to identify and find it in order to attach it to an email, then click the *Save* button:



Step 4. After a few moments a message should appear, indicating that the diagnostic file has been created successfully, similar to this:



Note down the name you gave the file and the folder in which you saved it, so that you can attach it to an email in the next step. Now click the *OK* button to dismiss the message.

If you do not see a success message, then please start again and make sure you type a name for the file when prompted, and that you select a folder that you are allowed to write to, such as you home folder (OS X) or your My Documents folder (Windows).

Step 5. Now use your email software to attach the diagnostic file to an email to your support provider. In that email please make sure that you also try to describe the problem as accurately and concisely as possible. Please see your email software's documentation if you need help on how to send email attachments.

Common problems and how to fix them

If the audio is breaking up, or the delay between pressing a key and hearing the sound is too long, please see the performance tuning section which covers the settings you need to adjust to prevent these problems.

If you hear a regular triangle chime, then Hauptwerk is running in evaluation mode. If you have purchased a license for Hauptwerk, make sure that you have the Hauptwerk USB key attached to a spare USB port on the computer and that the orange lamp within the key is lit. If you have only purchased or downloaded an evaluation copy of Hauptwerk, then the triangle chime is to be expected.

If you believe that you have configured the MIDI screens correctly but Hauptwerk's virtual keys and controls are not responding as expected, try closing Hauptwerk then using a diagnostic tool such as MIDI-OX or MIDI Monitor (see the links page on the Hauptwerk website) to show the MIDI messages that your computer is receiving. You may then be able to see whether the problem is due to your MIDI hardware or wiring or a setting on one of Hauptwerk's settings screens.

If nothing appears to happen when you double-click on the Hauptwerk icon, then it is likely that you have a corrupted audio driver that is freezing when Hauptwerk queries it during start-up, leaving Hauptwerk waiting for the driver to respond. Make sure that you uninstall any audio drivers for hardware that you no longer use. If the problem persists, please contact your Hauptwerk support provider for advice.

If an audio or MIDI device is configured for use with Hauptwerk, and is in use by another program when you attempt to activate Hauptwerk's audio and MIDI systems (for example, by loading a sample set), then errors will be reported. Hauptwerk must have exclusive access to all devices configured for use with it.

If you are using or evaluating the Advanced Edition of Hauptwerk and you hear xylophones, pianos or other odd sounds when playing virtual keys or changing the state of virtual switches, check that none of the paths on the *General settings | MIDI output paths* screen have their MIDI port set to 'Microsoft GS Wavetable SW Synth' or any other similar software synthesizer output, which would cause the other software synthesizer's sounds to be triggered in response to Hauptwerk's MIDI output.

Backup configuration files

Hauptwerk stores all of its settings in several configuration files, which are saved each time that you exit Hauptwerk or unload a sample set. Although it is extremely unlikely, if your computer was turned off or crashed at exactly the moment that the files were being saved, they could be corrupted. This could also happen if you tried to run two or more instances of Hauptwerk at the same time, which is why Hauptwerk prevents you from doing so.

To insure against such events, Hauptwerk automatically keeps a backup of the last known good configuration and silently restores it if it finds the corresponding settings file to be corrupted. A warning is written to the log file to alert you to the possibility that some of your recent settings changes may have been lost.

Creating sample sets

Creating a sample set or organ definition for Hauptwerk is a skilled and complex task, which requires a considerable investment of time and effort. We would only recommend undertaking the creation of a full sample set or organ definition if you are able to invest that time. The *Creating Sample Sets for Hauptwerk* guide, available on request from Milan Digital Audio has the necessary information.

For the creation of custom organ specifications for personal use, using samples from existing sample sets, the Custom Organ Design Module is provided, which is quick and simple to use, and is recommended for most users. See the design tools section for details. You can find the Custom Organ Design Module User Guide on Hauptwerk's *Help* menu.

Unless specifically advised to do so by the creator of a sample set, you must **never attempt to edit any part of an existing sample set directly**, including its audio samples, organ definition files, images and other components. For St. Anne's and the core Hauptwerk components editing a component can:

- Prevent the Hauptwerk software's main installer from being able to un-install or upgrade the components properly, and possibly thus Hauptwerk as a whole.
- Prevent Hauptwerk's component installer from functioning properly.
- Prevent Hauptwerk's Custom Organ Design Module from working properly.
- Prevent the St. Anne's sample set from loading properly.
- Prevent Hauptwerk's internal sample caching, configuration storage and other mechanisms from working for the edited sample set and potentially also others.

Most Hauptwerk audio and tremulant waveform samples contain special information which is not handled properly by many audio editors (multiple sample loops, stored pitch information, etc.), and making changes to a sample in such audio editors may corrupt that information, preventing the sample from working properly with Hauptwerk.

Editing Hauptwerk's core components is also explicitly disallowed by the Hauptwerk license agreement. License agreements for some third-party sample sets also explicitly disallow editing of their contents.

However, if you wish to try editing the St. Anne's sample set, you can do so by copying its installation package (ID 000002) to a new number in the 'user' ID range 800000-899999, copying its organ definition file to a new name and changing the ID in the organ definition file to a new number in the user ID range 800000-899999. Please only attempt this after ensuring you are thoroughly familiar with the contents of the *Creating Sample Sets for Hauptwerk* guide, and you do so at your own risk!