

Hauptwerk prerequisites

This section lists the platforms and hardware supported for use with Hauptwerk.

Computer platforms

The current version of Hauptwerk is supported on 64-bit Intel Apple Macs running Mac OS X, and on PCs running Windows.

If you are buying a new computer to run Hauptwerk, we particularly recommend the current range of Apple Macs, including the Mac Pro, MacBook Pro, iMac and Mac Mini, 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 quality and performance. Above all, because there are only a few models of Macs, there are far less variables than with PCs, so you can be more confident that you are buying a computer that corresponds closely to one that we've 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 'pro' audio/MIDI/Hauptwerk compatibility and performance, with a support/maintenance agreement, can be an equally good choice.

Processors

Hauptwerk is fully optimized for 64-bit multi-core/multi-processor systems. Very roughly speaking, the more CPU cores, the faster the processor, the more CPU cache, and the more recent the processor, the larger the number of organ pipes that are likely be able to sound at once in Hauptwerk.

On both Mac and PC platforms, recent Intel processors in the i7, i5 or Xeon ranges of processors ('Sandy Bridge' and later micro-architectures, with AVX instruction set support), with at least four CPU cores and at least 6 MB of shared CPU cache, are particularly recommended for best performance with large or complex organs in Hauptwerk.

On the Mac platform Hauptwerk is compatible with, and supported on, all 64-bit capable Intel Macs (all Macs made since about 2007). [This version of Hauptwerk will not work on older PowerPC (G4/G5) Macs or early Intel Macs with 32-bit processors.]

On the PC platform, Hauptwerk is compatible with, and supported on, Intel Pentium 4 and later Intel processors, along with AMD Athlon 64 and later AMD models. We particularly recommend recent Intel processors for maximum performance; recent AMD models are also good, but recent top-end Intel processors significantly out-perform the top-end AMD processors for Hauptwerk at the time of writing. Hauptwerk has native support for 64-bit Windows on 64-bit processors.

Although fast modern processors enable very large sample sets to be used, they are not requirements, and even a PC with a 2 GHz Pentium 4 processor should 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

A minimum of 2 GB of memory is required to use Hauptwerk with the included St. Anne's organ, and sufficient free memory is required to load any sample sets you intend to use into memory; Hauptwerk deliberately does not stream samples from hard-disk/SSD 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, 4 GB or more of memory is recommended. If you are buying a new computer specifically to run Hauptwerk, we normally recommend at least 8 or 16 GB.

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

Storage (hard-disk or SSD)

An absolute minimum of 6 GB of free storage 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 space. We recommend ensuring that you have at least 50-400 GB free if you wish to use a number of different sample sets.

The speed of your storage only determines the time it will take Hauptwerk to load a sample set; real-time performance should not be affected once the sample set is loaded into memory. SSD drives or RAID 5 hard-disk arrays can be used if you want sample sets to load quickly (RAID 5, RAID 1 or RAID 0+1 may also make your system more resilient to the failure of a hard disk). Note that RAID performance may depend significantly upon both the RAID controller and the disks used.

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 we strongly recommend using the NTFS file system (the default), instead of the older FAT32. FAT32 does not support files larger than 4 GB and thus prevents some large sample sets from installing properly.

Operating systems

On the Mac platform, Hauptwerk is compatible with, and fully supported on, 64-bit capable Intel Macs (all Macs made since about 2007) running either:

- OS X Yosemite 10.10 and above.
- OS X Mavericks 10.9.5 and above.
- OS X Mountain Lion 10.8.5 and above.
- OS X Lion 10.7.5 and above.

This version of Hauptwerk will not work on OS X versions prior to 10.7.

On the Windows platform, we recommend and fully support the following versions/editions of Microsoft Windows. These are the Windows platforms we use for testing and developing Hauptwerk, and we recommend them for best performance, stability and compatibility:

- 64-bit Windows 8.1 Pro.
- 64-bit Windows 8.1 (standard/home/non-Pro edition).
- 64-bit Windows 7 Professional, Service Pack 1 and above.
- 64-bit Windows 7 Home Premium, Service Pack 1 and above.
- 64-bit Windows 7 Ultimate, Service Pack 1 and above.

Hauptwerk will probably still work on 32-bit and 64-bit Windows XP and Vista, and on 32-bit Windows 7 and 8, although we no longer test with them, we wouldn't recommend them for new computers, and we'll only provide support for them for problems that can be reproduced on one of our primary supported Windows platforms listed above. (1)

Effective memory limits for use with Hauptwerk are as follows:

- 64-bit Windows 8.1 Pro: 512 GB.
- 64-bit Windows 8.1 (standard/home/non-Pro edition): 128 GB.
- 64-bit Windows 7 Professional or Ultimate Editions: 192 GB.
- 64-bit Windows 7 Home Premium Edition: 16 GB.

All editions of Windows 8.1 and Windows 7 support multi-core processors. However, support for two separate physical processors is only included in Windows 8.1 Pro, and in Windows 7 Professional and Ultimate editions.

64-bit versions of Windows 8.1 and Windows 7 are strongly recommended over 32-bit versions for computers that support them. Hauptwerk is natively optimized for 64-bit versions of Windows, and is able to perform significantly better on them, 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) 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 8, 7 or Vista the BCDEdit utility must be used to set the IncreaseUserVA value. It should only be attempted by experienced computer users, since it's very easy to render Windows unable to boot if any mistake is made. This [Microsoft MSDN page](#) also describes parameters for increasing the 2 GB per-application memory limit. Any such modifications are attempted at your own risk.

Operating system patches

All current operating system updates, service packs and driver updates should be applied when they are available. 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.

Java

Hauptwerk's installer uses Java (but Hauptwerk itself doesn't).

On Windows, if you are visually impaired, prior to running Hauptwerk's installer, please ensure that you have downloaded and installed the latest version of Java and that you have ticked the *Enable Java Access Bridge* option in the *Use the computer without a display* section of the *Ease of Access Center Windows* control panel.

Audio 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. Professional or semi-professional audio interfaces with high-quality digital-to-analog converters and drivers are strongly recommended above consumer-level sound cards for best quality, reliability, performance and minimal delay between pressing a key and hearing the sound ('latency').

Mac OS X has high-performance, professional-grade low-latency audio and MIDI support built in, so driver, performance or compatibility problems are uncommon.

On the Windows/PC platform the quality and compatibility of the drivers and components is particularly important for reliable low-latency audio and MIDI performance. Either ASIO or DirectSound drivers can be used, but good-quality manufacturer-supplied ASIO drivers are strongly recommended for 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 on some PCs only supports 44.1 kHz and so cannot be used with sample sets requiring other sample rates, such as 48 kHz.

Since it's impossible for us to test with all products, we recommend evaluating any candidate audio interface with Hauptwerk before purchasing it. Ensure that the interface is supported by its manufacturer on your computer platform and that you install the latest drivers for it, which can usually be downloaded from the manufacturer's website.

On Intel Macs, current audio interfaces in the following ranges are popular with Hauptwerk users (a Thunderbolt-to-FireWire adapter from Apple is needed to use FireWire interfaces with current Mac models):

- Echo Audiofire (FireWire) series.
- MOTU FireWire and USB interfaces
- RME FireWire and USB interfaces.
- PreSonus FireWire and USB interfaces.
- M-Audio FireWire and USB interfaces.
- E-MU USB interfaces.

On Windows, current audio interfaces in the following ranges are popular with Hauptwerk users:

- Echo Audiofire (FireWire) series. (1)
- MOTU FireWire, USB and PCIe interfaces
- RME FireWire, USB and PCIe interfaces.
- PreSonus FireWire and USB interfaces.
- M-Audio FireWire, USB and PCI interfaces. The M-Audio Delta 1010LT and M-Audio Audiophile 2496 are particularly popular and cost-effective (although many current PCs no longer accept PCI cards).
- E-MU USB and PCIe interfaces.

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

The [Echo](#), [MOTU](#), [PreSonus](#), [RME](#), [E-MU](#) and [M-Audio](#) websites have their full specifications.

If you want to use multi-channel audio output (Hauptwerk Advanced Edition) then the number of analog audio outputs that an audio interface provides will usually determine the maximum number of speakers that you will be able to use. Some interfaces (including the Echo Audiofires, MOTU 24 I/O and M-Audio 1010/1010LT) have drivers that allow multiple interfaces of the same model to be connected together and synchronized to increase the total number of analog audio outputs in total. Check with the manufacturer before buying an interface if you will need that capability.

MIDI interfaces

You will need a MIDI interface or USB music keyboard if you want to play Hauptwerk live (although you can evaluate it without one by clicking on the keys on the screen). Any MIDI interface supported by the manufacturer on your operating system and hardware should work with Hauptwerk. Good-quality professional or semi-professional MIDI interfaces are recommended above consumer-level USB-MIDI adapters for best performance and reliability.

Mac OS X has high-performance, professional-grade low-latency audio and MIDI support built in, so driver, performance or compatibility problems are uncommon.

On the Windows/PC platform the quality and compatibility of the drivers and components is particularly important for reliable audio and MIDI performance. On Windows, please note that we recommend avoiding small 'micro' USB-MIDI interfaces/adapters, such as the M-Audio MIDISPORT UNO, since we've found some to have insufficient buffering and to lose occasional MIDI messages when the computer's processor is heavily loaded, causing stuck notes in Hauptwerk. The MIDI interface that we've found to be most reliable (resilient against lost MIDI messages and resulting 'stuck notes' in times of extreme CPU load) is the MOTU Microlite, which we recommend for best performance and reliability, especially if you plan to use large/complex sample sets or if you plan to perform in public.

Many audio interfaces include MIDI IN and MIDI OUT ports anyway. If yours does, you probably won't need a separate dedicated MIDI interface unless you need extra MIDI ports to connect several MIDI devices to the computer simultaneously (such as multiple MIDI keyboards, MIDI organ consoles).

Since it's impossible for us to test with all products, we recommend evaluating any candidate MIDI interface with Hauptwerk before purchasing it. Ensure that the interface is supported by its manufacturer on your computer platform and that you install the latest drivers for it, which can usually be downloaded from the manufacturer's website.

On both Mac OS X and Windows the following dedicated MIDI interfaces are popular with Hauptwerk, all of which connect to the computer via USB:

- 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.

Details of the interfaces can be found on the [MOTU](#) and [M-Audio](#) websites.

Monitors and graphics cards

Hauptwerk requires a minimum display resolution of 1024 pixels width by 768 pixels height for your (primary) monitor, with at least 16-bit color depth. 1280 x 1024 or higher is recommended. Some sample sets may require higher resolutions to display at their optimal resolutions but Hauptwerk can zoom them to fit your screen. (Note that if you use your screen in a portrait orientation, then effectively 1024 x 1024 pixels becomes the minimum, otherwise Hauptwerk's menus and control panels would be too wide to fit 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. Hauptwerk's user interface is designed to support touch-screen use throughout.

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 jams on either side of your MIDI keyboards using two monitors.

[Novation Launchpads](#) are good, popular, similarly easy and convenient alternatives to touch-screens. They have a grid of robust buttons with multi-color LEDs in them that Hauptwerk can control natively to show stop states and functional groupings (by color). You can assign any button to any stop or piston in Hauptwerk and select the LED color you prefer for each, separately for each virtual organ. Hauptwerk also natively supports multiple Launchpads, so that you can use one for each stop jamb, for example.

VST and Audio Unit hosts

On Mac OS X the Hauptwerk VST Link is fully supported and tested with the following VST hosts:

- Steinberg Cubase 8.0.5 (64-bit). (2)
- Cockos Reaper 4.76 (64-bit).
- Sibelius 6. (2)

On Mac OS X the Hauptwerk AU Link is fully supported and tested with the following Audio Unit hosts:

- Apple Logic Studio Pro X 10.1.1. (1) (2)
- Apple Garage Band 10.0.3. (1) (2)
- Cockos Reaper 4.76 (64-bit).

On Windows the Hauptwerk VST Link is fully supported and tested with the following VST hosts:

- Steinberg Cubase 8.0.5 (both 64-bit and 32-bit). (2)
- Cakewalk Sonar 8.5 (both 64-bit and 32-bit). (2)
- Cockos Reaper 4.76 (both 64-bit and 32-bit).
- Sibelius 6. (2)

(1) This host doesn't support any MIDI output from plug-ins of this type (VST/AU), so can't be used to record MIDI pieces streamed directly via the Hauptwerk VST/AU Link (instead you need to use a virtual MIDI cable to connect Hauptwerk to the host, or use Hauptwerk's MIDI recorder to save them as MIDI files).

(2) This host doesn't support MIDI sys-ex with plug-ins of this type (VST/AU), so some virtual organ controls might not be recorded/played if streaming directly via the Hauptwerk VST/AU Link (instead you need to use a virtual MIDI cable to connect Hauptwerk to the host, or use Hauptwerk's MIDI recorder to save them as MIDI files).

Note that you can use Hauptwerk's native MIDI recorder/player while streaming Hauptwerk's audio output to a VST/AU host for applying real-time reverb/effects, so if you just want to use VST/AU for applying real-time reverb then there's no need to stream MIDI via the Hauptwerk VST/AU Link so issues (1) and (2) above would not be relevant.

The Hauptwerk VST/AU Links should be compatible with the majority of other VST and Audio Unit hosts. Although we can't test with all hosts, we'll 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.

Other MIDI sequencer software

In principle, any MIDI sequencer software should be compatible with Hauptwerk. Two 'virtual MIDI cables', or two physical MIDI cables and associated spare MIDI ports, are required to connect Hauptwerk to a non-VST/AU MIDI sequencer running on the same computer (or if your VST/AU sequencer doesn't support MIDI output from plug-ins but you want to use it to record and play back MIDI via Hauptwerk).

Mac OS X includes virtual MIDI cable functionality natively, called the 'IAC Driver', but it is disabled by default. On an Apple Mac please navigate to `/Applications/Utilities/Audio MIDI Setup`, select *Show MIDI window* from its *Window* menu, double-click on the *IAC Driver* icon, ensure that its *Device is online* property is ticked, click the *Add* button to increase the number of ports to at least two, then click *Apply* and select *Audio MIDI Setup | Quit Audio MIDI Setup* from the menu.

On Windows platforms a third-party program is required, such as [loopMIDI](#).

MIDI keyboards, organ consoles and MIDI controllers

To play Hauptwerk 'live' you need at least one MIDI keyboard, or a MIDI organ console, plus MIDI lead(s) to connect it to the computer's MIDI interface. Alternatively you can use one or more USB music keyboards (or you can evaluate Hauptwerk just clicking on the keys on the screen). Hauptwerk is designed to be natively 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, and Hauptwerk should be able to configure MIDI settings automatically. Please see the [Error! Reference source not found.](#) and [Error! Reference source not found.](#) sections 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/expensive MIDI equipment. Many Hauptwerk users use MIDI piston buttons to trigger Hauptwerk's combinations and touch-screens 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 jams on either side of your MIDI keyboards using two monitors.

[Novation Launchpads](#) are good, popular, similarly easy and convenient alternatives to touch-screens. They have a grid of robust buttons with multi-color LEDs in them that Hauptwerk can control natively to show stop states and functional groupings (by color). You can assign any button to any stop or piston in Hauptwerk and select the LED color you prefer for each, separately for each virtual organ. Hauptwerk also natively supports multiple Launchpads, so that you can use one for each stop jamb, for example.

(1) Multiple monitor support is only available with the Advanced Edition of Hauptwerk.

Amplifiers, speakers and 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 computer speakers – the results will almost certainly be very disappointing. 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 USB key functions reliably.

Adobe Acrobat Reader

Hauptwerk's documentation is in Adobe PDF format. Mac OS X and Windows 8.1 can display PDF documents natively, but on Windows 7 or earlier you need to make sure you have the latest version of Adobe Acrobat Reader installed. It can be downloaded from [Adobe's website](#).

General notes about hardware and software compatibility

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

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 hardware components 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 should give superb performance 'out of the box') or buying a PC from a company that offers ready-made high-performance PCs specifically designed, tested and supported for use with Hauptwerk. The MIDI hardware section on our website may be found by visiting www.hauptwerk.com/hardware and lists several such companies.