HAUPTWERK

VIRTUAL PIPE ORGAN
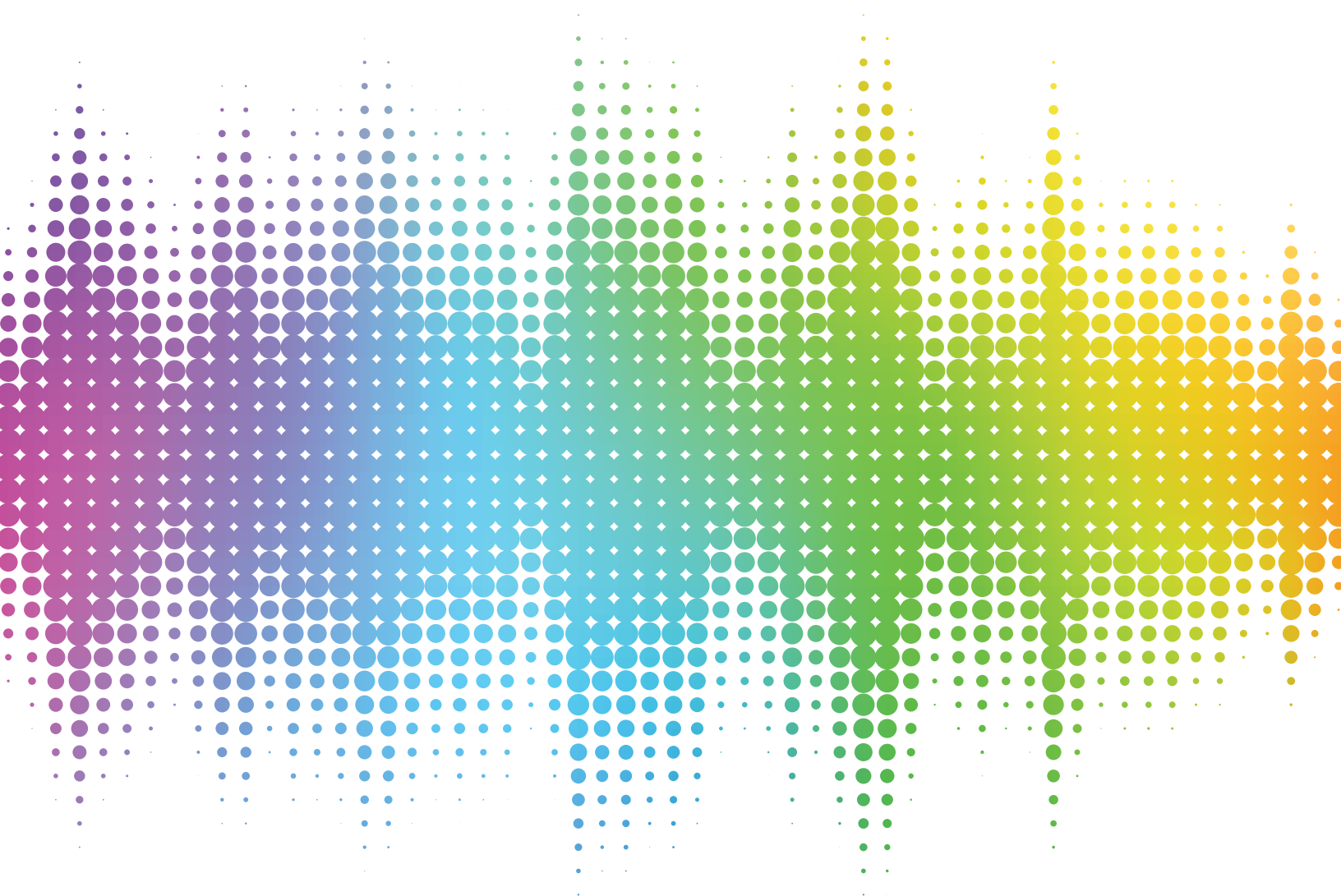
Hauptwerk 8.0.1 Release Notice

Contents

Overview

Hauptwerk version 8 is a major new version of Hauptwerk, superseding versions 1-7, and including significant enhancements for touch-screen use, audio routing and voicing, support for recent operating system and hardware platforms, and for performance, as well as many other smaller improvements. As for Hauptwerk versions 5-7, Hauptwerk is licensed via the PACE iLok system (instead of the 'Hauptwerk USB key' HASP dongle system that was used for versions 2-4).

There are some minor changes to minimum supported platforms.

Version 8.0.1 is a patch release containing bug fixes and minor compatibility fixes. We recommend updating to v8.0.1 if you are running v8.0.0.

Please have a look through the *Changes to Hauptwerk* section to find out what's included. We hope you enjoy it!

The most current source of information about Hauptwerk is the Hauptwerk website: *www.hauptwerk.com*. Please have a look there for updated information, downloads, tutorials, and lots more.

Licensing, Editions, Prerequisites, Installation, Technical Support, and Compatibility

Please first read the following sections in the current version of the main Hauptwerk user guide (available on the Hauptwerk website, or on the Help menu in this version of Hauptwerk), especially if you are installing Hauptwerk for the first time, or are upgrading from Hauptwerk versions 2-4:

- *Licensing, editions, and technical support*.

- *Hauptwerk prerequisites*.

- *Installation: background information*.

- *Installing Hauptwerk*.

- *Upgrading Hauptwerk*.

Important: if upgrading from Hauptwerk versions 2-4, then please also consult the Licensing changes section in this release notice, which covers some important changes to be aware of in v5+:

If upgrading from v2 and above, then your existing combinations and voicing will be preserved by default. If upgrading from v4+ then all settings will be preserved by default (although if upgrading from v4 you have the option to reset your audio/routing settings to defaults, so that you can reconfigure them optimally for v5+). (If upgrading directly from v2/v3, then please note that MIDI settings and audio engine preferences will no longer be migrated, although we strongly recommended resetting and reconfiguring MIDI settings for v4+ anyway, using right-click auto-detection on the relevant virtual controls.)

All sample sets that worked in v2 and above should work at least as well as they did in previous versions, the one important exception being that copy-protected v2-v4 sample sets cannot be loaded directly in this version *(*)*. Existing combinations, voicing, and settings should be preserved in either case (apart from MIDI settings specifically if upgrading directly from v2-v3, as above). Sample sets in Hauptwerk v1 format may be imported and used in this version too. It's our intention that all future Hauptwerk versions remain fully and seamlessly backwardly-compatible with this version.

In particular, if upgrading from v5.0.0 or above, then all settings, combinations, and voicing will be migrated, and sample sets (and sample set licenses) that were compatible with v5 will continue to work in this version.

Upgrades to this version from v1-v7 may be purchased from the Hauptwerk on-line shop on the Hauptwerk website, or from your re-seller. Subscription licenses may also be purchased from the Hauptwerk on-line shop. If you already have a valid, current subscription license then it can be used with this version.

For 'perpetual' (non-subscription) licenses, upgrades between minor Hauptwerk versions (for example between v8.0.0 and v8.0.1) are free to users with a valid license for v8, but a license upgrade must be purchased to upgrade between major versions (for example between v7 and v8), or between different Hauptwerk editions. All version upgrades (including this one) are included with subscription licenses (during the period for which the subscription has been paid for).

You can obtain the installers for the current version of the Hauptwerk software as a free download via the Hauptwerk website. Whether the software runs as the Advanced Edition or Lite Edition is determined by the type of license present. If no activated license is present for Hauptwerk v8 when Hauptwerk is launched, then the Hauptwerk software will run as a trial for up to 14 days (after which a license must be purchased in order to continue using it), whilst also providing an option each time on the launch screen to enter a license activation code.

Versions 1-6 are considered obsolete and are no longer available, developed, or supported in any way. Unless you have purchased (or have been supplied with) an upgrade to this version, v7 will continue to be supported for a maximum period of 12 months from the date you purchased a license for it (either a new license or an upgrade), but there will be no more v7 development, and we reserve the right not to assist with issues that would be resolved by upgrading to the current version.

Important note 1: Any given computer (operating system partition) can only have one version of Hauptwerk installed on it at any one time. Once a new version has been installed (even if only for evaluation purposes) it isn't possible to revert to a previous version without uninstalling Hauptwerk completely (selecting the uninstaller's option to remove all settings and files) then re-installing the older version, which would wipe any existing settings. Hence there's no easy way to revert to an older version of Hauptwerk once this version has been installed. (In case you do subsequently decide you want to revert to a previous version, please do make sure that you use *File | Backup ...* within the previous version <u>before</u> you install the newer version.)

Important note 2: When installing this version, please make sure that you refer to, and follow, the instructions in either the '*Upgrading or re-installing Hauptwerk*' section of the main Hauptwerk user guide (if upgrading an existing installation), or the '*Installing Hauptwerk*' section (if performing a new/clean Hauptwerk installation). Those sections contain some essential steps, especially if upgrading from v2/v3/v4.

Important note 3: If upgrading from a Hauptwerk v5, v6 or v7 Advanced Edition perpetual license: when activating the v8 license upgrade in iLok License Manager you will need to 'surrender' the license for your previous Hauptwerk version. (iLok License Manager will prompt you automatically to take you through the process, allowing you to choose the license to surrender.) Please note that once you have done so, it will not be possible to revert to running v5. However, versions 6.0.2 and above will accept a v8+ license as valid.

Note 4: If upgrading from v7 or earlier: the first time that you load any given organ in v8+, the organ's sample set cache will (re)generate, which may be slow (but subsequent loads should be fast, as previously). However, subsequently loading from cache is likely to be slightly faster in v8 than it was with v7.

***(*)* Additional important notes <u>if specifically upgrading from Hauptwerk versions 2-4</u>**:

- The previous 'Hauptwerk USB key' HASP dongle that was used for Hauptwerk v2-4 cannot be used for licensing this version of Hauptwerk, or for licensing sample sets.

- The current version of Hauptwerk isn't compatible directly with copy-protected sample sets that were created for pre-v5 versions, so please contact the makers of any such sample sets to obtain upgraded v5+ compatible versions if needed. If you have purchased an upgrade to v5+, once Hauptwerk v5+ has been installed, you will need to migrate any sample set licenses that you may have from your pre-v5 'Hauptwerk USB Key' HASP dongle (which will remove them permanently from that dongle, rendering it no longer usable), activate the replacement v5+ licenses for those sample sets in iLok License Manager, then use *File | Install …* to install the updated v5+ compatible versions of the sample sets. Your settings, voicing, and combinations for those sample sets shouldn't be lost in the process. When purchasing an upgrade to v5+ you will be sent instructions for the sample set license migration process (which involves using a special menu function once, then submitting the resulting file via a website form).

- Once you have used the special menu function to migrate your pre-v5 Hauptwerk sample set licenses to v5+ there is no way to reinstate those pre-v5 sample set licenses, nor to reinstate your pre-v5 Hauptwerk license itself. Hence please make sure that you do indeed wish to upgrade <u>before</u> you use the menu function to migrate your pre-v5 sample set licenses.

- On macOS you must use Finder manually to <u>delete your pre-v5 Hauptwerk installation completely *before* installing v5+</u>, otherwise a corrupted installation will result. You can use Hauptwerk's backup/restore functions to retain your existing settings/combinations/voicing. The '*Upgrade/re-installation steps on an Apple Mac computer*' section in the main Hauptwerk user guide covers the necessary steps. (These steps are necessary since pre-v5 versions of Hauptwerk were installed in a way that isn't compatible with changes Apple have made in recent macOS versions.)

Changes to Hauptwerk

All Hauptwerk releases since version 2 are cumulative, thus each includes all changes from previous Hauptwerk versions. Changes in version 4 and earlier aren't listed in this document, but can be found in the version 4.2.1 release notice (available separately) if needed.

Changes in version 8.0.1 above version 8.0.0

- Bug-fix: in v8.0.0 error 87 was possible when loading organs if using a Lite Edition v8 Perpetual license.

- Compatibility: a work-around has been added to retain compatibility with images in sample sets that have the wrong file extensions for their formats.

Changes in version 8.0.0 above version 7.0.1

New Touch Menu for touch-screens

Hauptwerk has a new 'Touch Menu' window, which has a tabbed interface designed specifically for convenient use from computer touch-screens and tablets (if used via screen-sharing software). It provides buttons and sliders to access almost all of the items on Hauptwerk's main menu and control panels. It can be opened or closed via:

- "*View | Touch menu*" from the main menu.

- A button on a new mini control panel, which is docked at the top of the main window when no organ is loaded, and also by default when an organ is loaded for the first time. (If you had loaded any given organ in a previous Hauptwerk version, then you can open the new mini control panel via "*View | Mini control panels … | Show/hide touch menu*" from the main menu.)

- The function can also be assigned to any of the virtual pistons on Hauptwerk's piston toolbars (by right-clicking on their buttons), and it's assigned to the piston toolbar that's shown by default for new Hauptwerk installations. (For existing installations, you could use the options on both the General Configuration Wizard and Organ Configuration Wizard to reset piston toolbar menu function assignments to their new defaults if you wished.)

- A keyboard shortcut (as shown on the main *View* menu).

- Assigning it to a MIDI piston (by right-clicking on its button, or via "*General settings | MIDI/key triggers for master pistons and menu functions*" from the main menu).

The Touch Menu window can be resized and will recall its position, size, and whether it was open or closed when launching Hauptwerk. If you have several computer monitors you might wish to keep it open on one of them, or to open/close it whenever needed from its mini control panel button (for example).

If its window is resized higher than its contents pane needs then its contents are zoomed in automatically. (Since the contents pane is quite high, zooming will only be possible on monitors with a high vertical resolution.)

To change the tab (and/or sub-tab) that's displayed on the Touch Menu, simply touch (or click on) the name of the tab.

Many of its controls support hold-clicking (or right-clicking) to auto-detect them to MIDI pistons.

Advanced Edition only: audio routing and voicing changes

- Ranks' audio can now optionally be routed directly to primary mixer buses, instead of via groups, which avoids the need to set up (or use) groups if routing ranks to individual speaker pairs. The "*Organ settings | Rank routing ...*" screen has been renamed accordingly, and now contains primary bus entries in its drop-down lists of destinations, in additional to the existing group entries. (Note also that output perspectives 2-4 are now routed directly to primary buses 2-4 by default when loading a new organ or resetting its rank routing, although default groups 2-4 continue to exist for compatibility with previously-loaded organs.)

- Hauptwerk now has 4 per-organ '*rank routing/voicing presets*' (in addition to the existing 128 audio '*mixer presets*', which aren't organ-specific, but each organ specified which of them it would use). Each one defines:

    o Which of the 128 mixer presets of it should route to.

    o A complete set of rank routing, as defined by the "*Organ settings | Rank routing to audio mixer buses/groups*" screen, with expandable nodes in its left-hand rank list for the four rank routing/voicing presets.

    o A complete set of rank voicing, as defined by the "*Organ settings | Rank voicing and surround/3D panning*" screen, with expandable nodes in its rank list for the four rank routing/voicing presets.

    For example, you could configure one rank routing/voicing preset optimally for headphones listening, and another for distributing pipes amongst multiple speakers. You might also choose to use one for experimenting with different routing and/or voicing without affecting the one(s) you normally use for the organ. In particular, this means that it is no longer necessary to use the four 'alt config N' configurations (desktop shortcuts) for those purposes.

    The rank routing/voicing preset that the currently-loaded organ should use is specified via the "*Audio Mixer, Routing and Voicing/Panning* Settings" large control panel (which also allows the mixer preset to be specified that the currently-selected rank routing/voicing preset should route to). The Touch Menu also has those settings. Also, a new mini control panel has been added to allow the rank routing/voicing preset to be selected, and the main "*Engine*" menu now has sub-menus for incrementing/decrementing the rank routing/voicing preset number.

    As for the existing mixer presets, the rank routing/voicing presets can be changed in real-time, with the results being audible immediately (except that you may need to re-trigger any held notes), and the functions for incrementing/decrementing the preset numbers can optionally be triggered from MIDI pistons/keys (by right-clicking on the corresponding buttons, or via the corresponding entries on the "*General/Organ settings | MIDI/key triggers for master pistons and menu functions …*" menus, and auto-detecting them), and/or assigned to piston toolbars.

    The previous menu function to reset all voicing and rank panning has been split into two separate functions: one to reset rank voicing/panning, and another to reset tremulant rate voicing.

    If upgrading from v5/v6/v7, your existing rank routing and voicing settings will automatically be migrated to rank routing/voicing preset number 1.

- Audio mixer presets may now be named, as well as rank routing/voicing presets, with maximum name lengths of 16 characters. Their names are displayed alongside their numbers wherever they appear on control panels, the Touch Menu, the audio routing settings screens, and the voicing screens. Their names are blank by default. To rename them, simply right-click on them. For example, in the case of the audio routing and voicing settings screens, right-click on their expandable nodes.

- To cater for the new rank routing/voicing presets, and for the ability to name presets, the following new MIDI output LCD panel line formats have been added:

  - "*Rank routing/voicing preset and reverb wetness scaler ['RkRVPr 4 Rv 100%']*".

  - "*Audio mixer preset name ['MultiChanAudio ']*".

  - "*Rank routing/voicing preset name ['Headphones   ']*".

  - "*Rank routing/voicing preset and audio mixer preset ['RkRPr 4 MxPr 128']*".

  … and the text of the following existing line format has been changed slightly:

  - "*Audio mixer preset and reverb wetness scaler ['MxPr 128 Rv 100%']*".

  Likewise, the following MIDI console status output system variables have been added:

  - "*AudioMixerBusesAndGroupsPresetName*" (max. length: 16 characters).

  - "*RankRoutingAndVoicingPresetCode*" (range: 1-4).

  - "*RankRoutingAndVoicingPresetName*" (max. length: 16 characters).

- The existing function for setting the audio mixer preset to 1 now also allows MIDI output.

- On the rank/pipe voicing screen the sliders, increment/decrement buttons, and their values, no longer have pop-up tool-tips, since they could get in the way. (The text is now instead available via the on-screen 'Help' button.)

Performance

- Hauptwerk's polyphony management system has been redesigned so as also to be able to distribute audio engine load efficiently amongst CPU cores which have different (or varying) performances relative to each other, such as the 'performance' and 'efficiency' cores available in 12th-generation and later Intel CPUs and Apple's M1/M2-series ARM-based CPUs. This may help to improve the polyphony that can be achieved on those types of CPUs significantly. **For example, on a PC laptop with a 12th-generation Intel i9 CPU, achievable static polyphony with Hauptwerk's highest audio engine quality was nearly three times higher than could be achieved on it using Hauptwerk v7.**

  In general, performance won't be affected on CPUs whose cores all perform equally, although it might also help in cases where other high-priority software/processes are using particular CPU cores heavily while Hauptwerk is running.

  The convolution engine has now also been updated to handle load-balancing across CPU cores whose performances are unequal.

  For diagnostics on Windows, the ranges of logical CPU core speeds [both current and maximum] are now logged whenever memory statistics are logged, and system and process CPU core affinities are now also logged.

- Hauptwerk now has the ability to organs unload faster by optionally allocating memory in larger chunks. Two new settings on the "*General settings | General preferences | Advanced ...*" screen tab control this functionality:

  - "*Reserve RAM in chunks for fastest organ unloading/loading [may use a little more memory]?*", which is ticked by default. Asking the computer's operating system to de-allocate (and, to a lesser extent, to allocate) RAM for organ samples individually can be slow, especially on Windows when a large amount of physical RAM is installed. If ticked, Hauptwerk will instead allocate memory in larger chunks, and put multiple samples into each chunk. This can make organs unload much faster. If ticked, Hauptwerk uses progressively smaller chunks as the computer's RAM fills, but may still use a little more RAM overall than if not ticked. In summary: keep it ticked if unloading speeds are more important to you than squeezing the maximum possible amount of data into your computer's RAM.

  - "*Max proportion of computer's RAM to keep reserved when unloading an organ (%)*", which allows values 0-65% and defaults to 60%. If this setting is non-zero, when unloading an organ Hauptwerk will keep up to the specified proportion of the computer's RAM allocated to itself, so that any organs that you load subsequently (until you next exit Hauptwerk) can load and unload faster. Set this to zero if you prefer to free up as much memory as possible for other applications every time that you unload an organ.

  N.B. Because the above "*Reserve RAM in chunks for fastest organ unloading/loading …*" setting is ticked by default, Hauptwerk v8 may need slightly more free RAM for any given organ than earlier versions did. Please ensure that you don't over-fill the computer's RAM. You can un-tick the setting if you wish.

  For diagnostics, Hauptwerk also logs memory chunk/allocation statistics whenever it logs memory other memory usage statistics, as well as times taken to unload organs.

- Sample set loading times from cache should be faster than with any previous version. (On recent computers with high-performance CPUs and NVMe SSDs times are typically 30-40% faster than v7.) If upgrading from any previous Hauptwerk version: the first time that you load any given organ in v8, the organ's sample set cache will (re)generate, which may be slow, but subsequent loads will be much faster.

- The '*medium*' audio engine processing quality mode (which in v7 corresponded to the v6 '*higher-definition pitch-shifting*' option) has been removed, leaving just the '*lower*' and '*higher*' options (which give the same audio qualities that they did in v7). Exactly as it did in v7, the '*higher*' option has significant and important quality and realism benefits above the former '*medium*' option, while being only a little more CPU-intensive than it.

  If upgrading from v7 and you were previously using the v7 '*medium*' option for any given organ (or if upgrading from v6 and you were previously using the '*higher-definition pitch-shifting*' option), then your polyphony limit setting will be migrated automatically to about 80% of its previous value to compensate approximately for the slightly higher CPU overheads of the '*higher*' option. You may wish to fine-tune that polyphony limit setting further for your system.

  Please note, if you are currently using 96 kHz for Hauptwerk's audio engine/output, and your computer struggles to handle the polyphony you desire then we recommend changing to 48 kHz. (96 kHz provides only a very small quality benefit above 48 kHz provided that the '*higher*' audio engine processing quality option is used, whereas the '*higher*' option provides major benefits compared to the former 'medium' option.)

  We highly recommend always using the '*higher*' audio engine processing quality option.

- A new advanced general preference has been added: "*Bind audio engine threads to CPU cores on Windows?*". Keep it ticked (as it is by default) for best performance, unless you specifically have problems with other high-priority software/processes using particular CPU cores heavily while Hauptwerk is running. If possible, it is much better to identify the relevant process and avoid running it when using Hauptwerk, instead of unticking this option. (If unticked, Hauptwerk never sets CPU core affinities for its threads on Windows, which on most PCs will yield lower performance and may risk audio glitches, especially if the "*Try to run Hauptwerk at real-time priority on Windows*" general preference isn't ticked, or if Hauptwerk hasn't been launched 'as Administrator'.)

- The CPU load from the wind supply model has been reduced marginally. The model is functionally unchanged, and its behavior should be no different.

- The performance of the audio routing screens has been improved marginally.

Novation Launchpad X (mark 3 model) support

Support has been added for the current Novation Launchpad X model. To use one with Hauptwerk no driver or software from Novation needs to be installed, and no manual configuration of the hardware is needed (although if you have several of them we do recommend configuring the "Device ID" setting of each of the units to unique values, as described in the "Settings" chapter in its user guide, so that the computer can tell them apart reliably). On the "*General settings | MIDI ports*" screen within Hauptwerk, you need to tick the following MIDI port entries:

- On Windows: on the "*MIDI IN ports*" screen tab: "*MIDIIN2 (LPX MIDI)*" (N.B. <u>not</u> "*LPX MIDI*"), and also:

- On Windows: on the "*MIDI OUT ports*" screen tab: "MIDIOUT2 (LPX MIDI)" (N.B <u>not</u> "*LPX MIDI*").

- On macOS: on the "*MIDI IN ports*" screen tab: "Launchpad X LPX MIDI In" (N.B. <u>not</u> "*... LPX DAW ...*"), and also:

- On macOS: on the "*MIDI OUT ports*" screen tab: "Launchpad X LPX MIDI Out" (N.B. <u>not</u> "*... LPX DAW ...*").

After clicking OK, the Launchpad's LED lamps should then clear automatically, and you should then be able to right-click on virtual pistons/buttons/stops/switches to auto-detect then to any of the Launchpad X's buttons. When doing so you should be able to select the desired color for the Launchpad button's LED, for which you should choose one of the "*Launchpad Mk2+: ...*" entries.

Note: we have also implemented the Launchpad X support in such a way that it is likely also to be compatible with the Launchpad Mk3 Mini model (if its equivalent MIDI ports are enabled, similar to the list above), although it is not guaranteed, and we don't officially support the Mk3 Mini model.

Platform support and prerequisites changes

- Support for recent macOS versions has been improved, and macOS 13 'Ventura' is now fully supported.

- Apple Macs with 'Apple silicon' (ARM-based M1/M2-series) CPUs are now fully supported, running under Apple's Rosetta translator.

- The minimum supported macOS version is 10.13.6, and in order to support recent macOS versions properly Hauptwerk will no longer run on macOS versions less than 10.13.

- Microsoft no longer support Windows 7, and the minimum Windows version that we support fully is now Windows 10. Hauptwerk may continue to work on Windows 7 (and we understand that Hauptwerk v8 does actually work well on it), but we no longer test on it. We will provide support for issues on Windows 7 provided that they are reproducible on one of our supported platforms and that they don't appear to be related to the platform.

Other changes

- A new general preference has been added: "*Stepper and master general combinations store/recall current floating division route numbers?*" which defaults to not ticked. If ticked, the current route numbers for each of the floating divisions are stored in, and recalled from, stepper and master general combinations. Please note: if the preference was not ticked when any given combination was captured then recalling that stored combination won't affect floating division routes, even if the preference is subsequently turned on; in order to do so you would need to capture the combination again (e.g. after recalling it, then setting the floating division routes as desired). Likewise, the default (all-off) combinations stored within automatically-generated default combination sets don't affect floating divisions if recalled.

- The floating divisions have new functions (which can be assigned to MIDI pistons, and/or to piston toolbars) to toggle between their first and second routes. The layouts of the floating division control panels have also been tweaked slightly.

- The component installer now allows organs to be installed or uninstalled even if licenses aren't present for them yet, or if the appropriate licensing packages haven't been installed yet. (However, the appropriate licenses and licensing packages still need to be present in order actually to load organs once installed, and clear error messages are shown if they aren't, with a link to download the current licensing packages file if applicable.) Please note that usually Hauptwerk's component installer would intentionally prevent an organ definition with a lower version number from being installed over a higher version of the same organ definition. However, in the absence of an appropriate license (or licensing package) it cannot read them to query their version numbers, so if installing several different versions of the same organ definition in the absence of a license (or licensing package) then it's important that you install the highest version last.

- The "*Try to run Hauptwerk at real-time priority on Windows ...*" advanced general preference's name has been tweaked to make it clearer that running at real-time priority requires Hauptwerk to be launched from Windows 'as administrator'.

- The menu function/button to minimize the console windows is now ticked/lit if (and only if) all open console windows are minimized.

- Arrow buttons and icon buttons on control panels now have accessibility text for visually-impaired users. Also, the accessibility text for piston toolbar pistons has been improved.

- The keyboard shortcut for pasting registration from the clipboard has been changed, and there is no longer a keyboard shortcut for triggering floating division 1 route 4 (due to a shortage of computer keys for other more-commonly-used functions).

- Custom Organ Design Module/sample set developers: When importing or exporting an organ database, the database selection screen now defaults to the entry you selected last time.

- The functions assigned by default to the piston toolbars have been tweaked. (Existing assignments won't change unless you reset their assignments to defaults.)

- On the "*Audio, MIDI and Performance*" large control panel, the text of the "*Audio engine prefs*" button label has been changed to "*Organ audio engine prefs*" for clarity.

- The paths of recently-loaded MIDI files are now abbreviated if needed on the menu to avoid making the menu too wide.

Bug fixes

- Since v5.0.0, if audio was sounding through output perspective 2, but nothing was sounding through perspective 1, then the audio mixer's signal activity LED for perspective 1's bus(es) would incorrectly light up (in addition to that for 2, which would correctly light up). Likewise for output perspective 3's LED if sounding through perspective 4 but not 3. (However, audio itself was working correctly; it was only the virtual LEDs which could light up spuriously, and in practice it would be unusual to route some ranks to perspectives 2 or 4 without also routing some through 1 or 3.)

- Since v4, when assigning either of floating divisions 4 or 5 route decrement functions to a piston toolbar piston, the default label text for the piston would incorrectly indicate that it was an 'increment' function.

- Since v2, if a sample set producer specified a key range for a Keyboard object that exceeded the valid MIDI note number range of 0-127 Hauptwerk would crash.

Changes in version 7.0.1 above version 7.0.0

- The control panel buttons (and associated toolbar piston functions) which show/hide large control panels now light up whenever their control panels are visible, so as to make it more immediately obvious that they can be clicked on to close their control panels, and more obvious at a glance which of the buttons to press to hide an open control panel.

- Bug-fix: since v7.0.0, MIDI pistons/stops/switches that send MIDI control change messages would fail to auto-detect to menu functions (control panel or piston toolbar buttons). Other types of MIDI messages (including MIDI note-on/offs, program changes, NRPNs, etc.) and other types of virtual controls (such as virtual expression pedals/sliders, stops, or a sample set's native virtual pistons), would auto-detect properly. Since MIDI control changes are rarely used for MIDI stops/pistons, the problem was usually only relevant if trying to auto-detect the top/side rows of round buttons on Novation Launchpads to menu functions.

- Compatibility fix: a change that was introduced in v5.0.0 to ignore MIDI sys-ex messages of a specific format for compatibility with certain Classic MIDI Works devices prevented some pistons on certain Content organ models from being recognized.

- Bug-fix: since v5.0.0, if audio was sounding through output perspective 2, but nothing was sounding through perspective 1, then the audio mixer's signal activity LED for perspective 1's bus(es) would incorrectly light up (in addition to that for 2, which would correctly light up). Likewise for output perspective 3's LED if sounding through perspective 4 but not 3. (However, audio itself was working correctly; it was merely the virtual LEDs which could light up spuriously, and in practice it would be unusual to route some ranks to perspectives 2 or 4 without also routing some through 1 or 3.)

Changes in version 7.0.0 above version 6.0.2

Audio engine changes

- The "*Real-time audio pitch-shifting quality*" organ preference has been renamed to "*Audio engine processing quality*", and now offers the following three choices:

    o "*Lower (not recommended; least CPU-intensive; legacy v2-v5 quality)*".

    o "*Medium (about 50% less polyphony; legacy v6 'HD pitch-shifting' quality)*".

    o "*Higher (recommended; lower distortion; about 60% less polyphony than 'lower')*".

[Please note: the '*medium*' option has been removed in Hauptwerk v8+.]

In terms of how pitch-shifting and real-time filters are processed within the audio engine, the 'medium' mode behaves as v6's 'higher definition' pitch-shifting mode did, and the 'lower' mode behaves as v2-v5 did (and as v6 did without its 'higher definition' pitch-shifting mode enabled). The lower/medium modes give comparable performance (in terms of CPU overheads and polyphony) to their equivalents in previous Hauptwerk versions (possibly very slightly less than in v5-v6 due to other minor sonic improvements that are present in all modes).

In addition to higher-quality pitch-shifting (as enabled by the 'medium' mode), the new 'higher' mode also enables higher-quality filter processing, giving a further significant and noticeable reduction in distortion and increase in clarity, especially for modeled tremulants, the wind supply model, and modeled swell boxes. Please note, however, that the 'higher' option is accordingly more CPU-intensive, typically giving a reduction in achievable polyphony of about 25%, compared to the 'medium' option, or a reduction of about 60% compared to the 'lower' option. If changing the preference, you may need to adjust your polyphony limit setting for the organ accordingly. Nonetheless, if you have a sufficiently powerful CPU, using the 'higher' option is highly recommended for best results.

Please note also that in the lower/medium modes, dynamic modulation of the harmonic-shaping filters is still disabled for deep bass pipes (as it was in v6.0.2, as a work-around to reduce potential filter distortions that could occur in v2-v6, especially at 96 kHz). That is no longer necessary for the much lower-distortion filters enabled by the new 'higher' mode, so dynamic filter modulation of deep bass pipes is enabled in the 'higher' mode.

(Note also that disabling the harmonic-shaping filters completely no longer saves any CPU overheads, compared to having them enabled.)

There is also a new "*Tremulant/wind supply/swell box/relay model quality*" organ preference, with the following three choices:

    o "*Lower (not recommended; least CPU-intensive; legacy v2-v4 quality)*".

    o "*Medium (good balance of quality vs. CPU overheads)*".

    o "*Higher (caution: needs high per-CPU-core performance for large organs)*".

It controls the time resolution at which Hauptwerk's tremulant, wind supply, swell box, and relay models are processed, and thus their quality, accuracy, smoothness, realism, and response. Higher settings are more CPU-intensive, but give noticeably better results and overall clarity, provided that your computer has sufficient processing power to handle it. Per-CPU-core performance (especially CPU base clock speed) is particularly important for the models, even if your CPU has lots of cores. For the 'higher' option to work well with very large organs your CPU will need to have very high per-CPU-core performance, as well as plenty of CPU cores. Hence the 'medium' mode is the default.

The 'lower' mode processes the models at a similar resolution to v2-v4, the 'medium' mode comparably to v5-v6, and the 'higher' mode now processes them at an even higher resolution, again giving noticeably better results. Also, the previous "*Reduce relay/MIDI/tremulant/model response/accuracy/quality for max polyphony*" organ preference has been removed, with the 'lower' mode of the new "*Tremulant/wind supply/swell box/relay model quality*" preference instead providing the much lower-resolution model processing (v4-quality) that the "*Reduce relay/MIDI/tremulant/model response/accuracy/quality for max polyphony*" preference did in v5-v6.

Because processing the wind supply model at different resolutions may slightly affect the behavior of the wind supply, in the Hauptwerk Advanced Edition a new "*Wind model organ pipe flow adjustment*" preference has also been added on the "*Organ settings | Organ preferences | Wind supply model*" screen tab, allowing you to reduce the amount of air that each organ pipe draws from the wind system when it sounds, in case the wind system is too unstable or 'wobbly'.

Whenever loading any given organ for the first time in v7 the Organ Configuration Wizard will run, prompting you to select/confirm your choices for the preferences. If upgrading to v7 from an earlier version, they default to the equivalent modes from the earlier version.

In summary, we recommend selecting the new 'higher' mode for the "*Audio engine processing quality*" organ preference for all organs, and the 96 kHz sample rate option on the "*General settings | Audio device ...*" screen, if you have sufficient CPU horsepower, since they will yield significantly and noticeably better results. For the "*Tremulant/wind supply/swell box/relay model quality*" organ preference we recommend selecting the 'higher' mode (only) if:

- o   The organ is a theatre organ, or:

- o   The organ is reasonably small (without an excessively demanding wind supply model), or:

- o   Your CPU has very high per-core performance (including a very high CPU base clock speed).

In other cases, we recommend selecting the 'medium' option for the "*Tremulant/wind supply/swell box/relay model quality*", and if in doubt, select the 'medium' option.

The sonic benefits of the 'higher' modes for the two preferences may be particularly easy to hear on modeled tremulants (especially modeled deep tremulants, as found on some theatre organ sample sets) and on organs with very dynamic wind supplies.

- The background models -- tremulants, wind supply model, swell boxes, etc. -- are also processed with slightly tighter timing in general, giving an additional small improvement in realism, even for the 'legacy' quality modes.

- The work-around that was included in v6.0.2 to avoid distortion/popping from the harmonic-shaping filters (especially at 96 kHz with deep bass pipes) would smooth extreme and rapid changes in pipes' brightness. However, that could yield noticeably slightly different results from pre-v6.0.2 Hauptwerk versions if the user had turned the wind supply model's modulation up a lot with certain sample sets that have very 'dynamic' wind models (especially the Sonus Paradisi Groningen St. Martini), and on certain theatre organ pipes when affected by very deep/sharp tremulants. Hence that smoothing is no longer performed.

Per-organ vs. global MIDI assignments to menu/master functions

- A new "*Organ MIDI assignments override global?*" option has been added on the "G*eneral settings | General preferences*" screen. If ticked (as it is by default), for any given organ, if you have auto-detected/assigned any given MIDI control (MIDI piston, MIDI draw-knob/tab/button, etc.) or computer key to trigger both one or more global ('for all organs') menu/master functions, and also one or more organ-level ('for this organ') menu/master functions (and/or the organ's native controls, such as virtual stops), then only the organ-level assignment(s) will be triggered when the MIDI/key event is received [with the global assignment(s) being ignored for that MIDI/key event]. This allows any organ-level MIDI/key assignments to override global assignments, for example allowing you to assign a given MIDI draw-knob to a particular coupler for organs that include it natively, but reverting to using a master coupler for organs that don't. Likewise, for example, you might wish to assign a given MIDI piston to trigger an organ's native divisional piston if present for the organ, but revert to using a globally-configured Hauptwerk master scoped combination if not.

- On the "*Organ settings | Organ Configuration Wizard*", the previous single "*Reset MIDI/key trigger settings for all organ controls and Hauptwerk functions for this organ?*" option has been replaced by three separate options, allowing finer control over which types of MIDI settings to reset:

  o *"Reset MIDI/key trigger settings for all organ controls for this organ?"*.

  o *"Reset MIDI/key trigger settings for all 'for this organ' Hauptwerk master/menu function assignments?"*.

  o *"Reset MIDI settings for all 'for this organ' LCD panel assignments, and custom MIDI configuration messages?"*.

  In particular, you may find the second of those options useful if, for Hauptwerk v5 or earlier, you had previously configured Hauptwerk master pistons or menu functions on a per-organ basis, but now instead wish to configure those controls identically for all organs, as possible in v6 and above. Likewise, the third option may be useful if you had previously configured LCD panels on a per-organ basis, but now wish to configure them globally (as also possible in v6 and above). Please note that the three options (as with all other options on the Organ Configuration Wizard) will affect the currently-loaded organ only, so in those situations you would need to load each organ in turn, using the wizard's relevant option(s) to reset the desired types of previous MIDI settings for that particular organ.

- During auto-detection, if warning that multiple functions are assigned to be triggered by the same MIDI/key event, each of the items in the list of such functions is now prefixed by 'For all organs' or 'For this organ only' for clarity.

- During auto-detection of an organ-level function or virtual control, any 'for all organs' functions that had also been configured to be triggered from the same MIDI/key event won't be listed or cleared, if they would automatically be overridden anyway due to the "*Organ MIDI assignments override global?*" general preference being ticked.

- When auto-detecting MIDI/key settings for a menu/master function globally ('for all organs'), per-organ MIDI/key settings are now automatically cleared for that particular function (for the currently-loaded organ, if any).

- If any MIDI/key input is configured for a given menu/master function on a per-organ basis then any MIDI/key input configured globally _to that same function_ is now *always* ignored, thus avoiding the same menu/master function potentially being triggered twice in situations where you wish to configure the MIDI/key input to it differently for one organ than for other (globally-configured) organs. (Note that this behavior isn't affected by the "*Organ MIDI assignments override global?*" general preference, which instead applies if a given MIDI/key has been auto-detected to trigger an organ function that _is different from_ the global function to which it has also been auto-detected.)

Also, when auto-detecting menu/master functions, the auto-detection wizard no longer warns about duplicate assignments in the case that the other object is the same menu function but assigned at the opposite (general/organ) level (since in v7+ that opposite duplicate assignment would be cleared automatically anyway).

- When right-clicking on control panel buttons or piston toolbar pistons, the existing option to clear all MIDI settings has been clarified to indicate that it does so both for globally ('for all organs') and for the currently-loaded organ. There is also now an additional option to clear all MIDI settings for the currently-loaded organ only.

Control panels and piston toolbars

- As in previous versions, Hauptwerk has on-screen virtual piston toolbars which can be docked around the virtual console window, to allow convenient access to its menu/master functions for touch-screen users, and you can/could (re)assign functions to those virtual piston toolbars' pistons by right-clicking on them. In previous versions, such function assignments were always on a per-organ basis, i.e. functions that you assigned to them within one organ would not affect assignments within any other, so you would need to assign functions to them separately for every organ (even if you always wanted the same functions to be assigned to them).

  However, in v7+ when right-clicking on a piston toolbar piston, a menu/master function may now be assigned to it either globally ('for all organs, unless overridden') and/or only for the currently-loaded organ, with any such per-organ assignment overriding the global assignment for that particular piston toolbar piston, for that particular organ. That avoids the need to duplicate the same function assignment for every organ, in cases where you usually (or always) want the same function to be available on a given piston toolbar piston, whilst still allowing you to customize (override) the assignment in case you want to do that for certain organs.

  There is also a right-click menu option to clear an overridden function assignment (if any). By default, when loading a new organ for the first time (ever), global assignments are not overridden for it, i.e. the global assignments apply by default. However, if loading an organ that had been loaded in a previous Hauptwerk version, the organ's existing per-organ assignments will be migrated and retained.

  There are new options on both the General Configuration Wizard and the Organ Configuration Wizard for resetting piston toolbar menu function assignments (globally, and where overridden for the currently-loaded organ, respectively). If you're upgrading to v7 from an earlier version (for which piston toolbar function assignments were always per-organ), and you now instead wish to assign functions globally, then for each organ in turn you should use "*Organ settings | Organ Configuration Wizard*" with the "*Clear piston toolbar menu function assignments that have been overridden for this organ, and customized names*" option ticked (unticking all other options, unless you specifically want to clear anything else too).

- You can now customize the label text that's shown for any given menu/master function on piston toolbar pistons. To do so, right-click on a toolbar piston to which the relevant function has been assigned. The function's label text can be customized globally ('for all organs, unless overridden') and/or overridden for the currently-loaded organ. Overriding label text on a per-organ basis might be particularly useful for master couplers or master scoped combinations, for example, so that you could label them appropriately according to which divisions they affected on the relevant organ. There are also right-click options to clear the function's customized text globally, and/or if overridden. The function's default label text is used if you clear the customized label text entirely. No label text is customized or overridden by default. The "*Clear piston toolbar menu function assignments that have been overridden for this organ, and customized names*" options on the General Configuration Wizard and Organ Configuration Wizards can be used for resetting piston toolbar's customized label text (as well as menu function assignments, as above).

- Large control panels can now store/recall their last-used positions when you (re-)open them, and it is also now possible for other large control panels to be closed automatically whenever opening a large control panel. Two new preferences have been added to the "*General settings | General preferences*" screen accordingly:

  o "*When opening/closing large control panels, store/recall their positions*", with options "*globally*" and "*per-organ*". It determines whether large control panels' positions are stored/recalled globally ('for all organs') or per-organ, specifically (and only) when you open or move those control panels. (However, if a control panel is left open when unloading an organ, its position will always be stored/recalled on a per-organ basis, as in previous Hauptwerk versions.)

- o "*When opening a large control panel, close all others?*": You might find this convenient if you prefer to have large control panels open only whilst you need them, opening/closing them via MIDI pistons or piston toolbars, for example.

  (Also, the previous 'Main' screen tab on the General Preferences screen has now been split across two tabs, 'Main 1' and 'Main 2', to accommodate more settings.)

- There are two new mini control panels named "*Show/hide large floating control panels 1*" and "*… 2*", which have buttons to show/hide each of the large control panels. The first of the two panels has buttons for the most commonly used large control panels. They're intended for touch-screen users and for those short of screen space. For example, by keeping just the "*Show/hide large floating control panels 1*" mini control panel shown/docked constantly, you can quickly and easily access any of the main large floating control panels and their (many) functions whenever needed, instead of needing to keep those large control panels (or their mini control panel equivalents) open constantly (wasting screen space). You might also find this particularly convenient in conjunction with the new "*When opening a large control panel, close all others?*" general preference. "*Show/hide large floating control panels 1*" is shown by default the first time (ever) that any given organ is loaded, docked at the top of the main window.

- You can also now assign any of the large control panels to be opened/closed from virtual piston toolbar pistons – also particularly handy for touch-screen use. As usual, right-click on a piston toolbar piston if you wish to change which function is assigned to it. With default assignments, the most commonly used large control panels are assigned to be shown/hidden from piston toolbar 1, which is docked at the bottom of the main console window by default. Hence for a new installation (or after using the "*Clear piston toolbar menu function assignments that have been overridden for this organ, and customized names*" options on the General Configuration Wizard and Organ Configuration Wizards) there are convenient buttons on the screen for showing/hiding any of the main large control panels whenever needed.

- Likewise, you can now assign any of the settings screens on the "*General settings*" and "*Organ settings*" menus (including the real-time audio routing screens, and the two voicing screens) to be shown from piston toolbar pistons.

- You can now assign any of the large control panels to be opened/closed from MIDI pistons/buttons or computer keys. To do that, for example, open the "*Show/hide large floating control panels 1*" (or "*… 2*") mini control panel, and right-click on its buttons to auto-detect pistons/buttons/keys to them. Alternatively, you could use the auto-detection button on the "*General settings | MIDI/key triggers for master pistons and menu functions (for all organs)*" screen (or the equivalent per-organ screen on the "*Organ settings*" menu), having highlighted the relevant entry in the left-hand list of functions, or you could right-click on piston toolbar pistons to which the relevant show/hide functions have been assigned (if applicable).

- For convenience, pre-defined computer keyboard short-cuts have also been added to open/close the most commonly used large control panels. Those short-cut key combinations can be viewed via the "*View | Large floating control panels …*" menu.

- There is a new large floating control panel named "*Load/install organs*", bringing all of the related together for convenience (especially for the benefit of those who may wish to show/hide the large control panels whenever 'on the fly' in v7, e.g. from touch-screens).

- There is another new large floating control panel named "*MIDI and preferences screens*", which has convenience buttons for opening the two preference screens, as well as the main MIDI settings screens (excluding some from the "*Organ settings | Advanced MIDI applications*" sub-menu, which few people use).

  (Note also that, as in Hauptwerk v5/v6, you can open the voicing/panning screen and/or the real-time audio routing screens, such as the mixer, via the "*Audio Mixer and Voicing/Panning Settings*" large control panel.)

- The layouts of many of the existing large control panels have been tweaked, and most remaining menu functions have been added to them, so that the large control panels can now be used as convenient 'on the fly' alternatives to the main menu system. For example, the "*Audio, MIDI and Performance*" large control panel now has dedicated convenience buttons to: (re-)load the organ, adjusting rank memory options; change audio device settings; and adjust audio engine preferences. Please note that in order to accommodate additional functions within the available space, the stepper trigger xx0, …, xx9 buttons have been removed from the "*Registration*" large control, but they can still be found on the dedicated "*Combination stepper (all)*" large control panel, as before.

- The very first time that any given organ is loaded, no large control panels are now displayed by default (since they may be opened/closed more conveniently from the "*Show/hide large floating control panels 1*" mini control panel, which is shown by default docked at the top of the main window, or via the piston toolbar pistons).

- When right-clicking on control panel buttons or piston toolbar pistons, the layout and text of the right-click menus have been changed so that their menu sub-sections now have sub-headings where appropriate, to aid clarity and compactness (and to ensure that the menus continue to fit within the minimum required screen width without introducing spurious levels to navigate).

Advanced Edition only: audio routing changes

- On the "*General settings | Audio mixer*" and "*General settings | Audio mixer bus groups*" screens the items (mixer buses and groups) in the left-hand browse lists are now organized within expandable 'Mixer preset' category nodes, making it clearer and quicker to navigate, with all of the relevant entries for any given mixer preset appearing together. (Accordingly, the names of the individual buses/groups no longer show prefixes for the preset number.)

    For convenience, whenever one of those two screens is opened, its node for the organ's current mixer preset is expanded by default if an organ is currently loaded, otherwise its '*Mixer preset 1*' node is expanded by default. (The expanded node does not change automatically if you change the organ's mixer preset whilst the screen remains open.) If desired the expanded node can be closed with a single mouse click, then a different mixer preset node expanded.

    The mixer preset node names on the Audio Mixer and Audio Mixer Primary Bus Groups screens now also clarify that their entries are mixer buses, and groups, respectively, with the individual bus/group name prefixes shortened accordingly for clarity, compactness, and to avoid duplication. Also, for clarity the words 'primary', 'master', and 'group' are no longer abbreviated in prefixes shown for the individual bus/group names.

- The number of audio mixer presets has been increased from 8 to 128, potentially allowing per-organ configuration of mixer buses and groups, for up to 128 organs.

- Each of the real-time audio/routing settings screens now has a new column of blue virtual activity LEDs. If an organ is loaded, they indicate whether each of their items is currently configured potentially to be audible. Specifically:

    o For the "*General settings | Audio mixer*" screen: the blue indicator LED will be lit (only) if an organ is currently loaded, *and* the bus belongs to the organ's currently-selected mixer preset, *and* anything is routed to the bus (if a primary bus: if it belongs to any groups – even if no ranks are routed to those groups; or if a mix bus: if any buses send to it), *and* the output of the bus is routed anywhere (to audio device channels directly, or indirectly via mix buses). Hence if an organ is currently loaded and if the blue LED is *not* lit, then nothing will be able to be heard through the bus.

    o For the "*General settings | Audio mixer bus groups*" screen: the blue indicator LED will be lit (only) if an organ is currently loaded, *and* the group belongs to the organ's currently-selected mixer preset, *and* any ranks are routed to the group, *and* the group is non-empty (contains any buses). Hence if an organ is currently loaded and if the blue LED is *not* lit, nothing will be able to be heard through the group.

    o For the "*Organ settings | Rank routing ...*" screen: the blue indicator LED will be lit (only) if the rank is currently loaded into memory *and* the rank is routed to at least one non-empty bus group. Hence if the blue LED is *not* lit, the rank will not be audible.

- The virtual activity LEDs on real-time audio settings screens now have black backgrounds, so that it's easier to see when they're lit, and the duration of their flashes has been increased, so that it's easier to see their activity. In particular, that makes it more immediately obvious where things are being routed on the real-time audio settings screens.

- You can now change which audio mixer preset an organ uses in real-time (without audio/MIDI needing to re-start), via new +/- buttons on the "*Audio Mixer, Routing and Voicing/Panning Settings*" large control panel (or via a new submenu on the main "*Engine*" menu). As with any other control panel buttons, they can be auto-detected to MIDI pistons/buttons/keys. The previous (non-real-time) setting for it on the "*Organ settings | Organ preferences*" has been removed accordingly. (Please note: when changing the mixer preset any held notes will need to be re-triggered.)

- Two new mini control panels are available (which duplicate the behavior of the equivalent controls from the corresponding large control panels):

  o "*Master impulse response reverb wetness scaler*".

  o "*Audio mixer preset*".

- For displaying the mixer preset via MIDI a new MIDI LCD panel line format is available: "*Audio mixer preset and reverb wetness scaler ['Prst 128 Rv 100%']*" (which also includes the master reverb wetness slider). Also, a new MIDI console status output system variable "*AudioMixerBusesAndGroupsPresetCode*" is available, with data-type '28-bit signed integer' and range 1-128.

- Documentation: the audio routing examples in the user guide have been improved and expanded upon, with a new dedicated example for routing ranks to stereo speaker pairs directly according to division.

- There is a new convenience button on the "*Audio Mixer, Routing and Voicing/Panning Settings*" large control panel for showing the tremulant rate voicing screen (for organs that use modeled tremulants).

- On the real-time audio/routing screens, the "*rank not loaded ...*" and "*no buses in group ...*" suffix text has been shortened a little, to aid readability/clarity. Also, the layout of the convenience buttons which open other related screens has been made more compact, and the "*... (advanced ...)*" suffixes on control panel buttons, and on buttons on audio screens, have been removed for compactness.

Other changes

- Settings screens now store and recall their positions and sizes, as do the screens for choosing organs, combination sets, temperaments, Custom Organ Design Module organs, SQLite databases, etc. to load/save/import/export.

- You can now assign any of the settings screens on the *"General settings"* and *"Organ settings"* menus (including the real-time audio routing screens, and the two voicing screens) to be opened from MIDI pistons/buttons or computer keys. To do that, use the auto-detection button on the *"General settings | MIDI/key triggers for master pistons and menu functions (for all organs)"* screen (or the equivalent per-organ screen on the *"Organ settings"* menu), having highlighted the relevant entry in the left-hand list of functions. (Alternatively, you could use right-click auto-detection on the buttons on the relevant large control panels that show/hide the screens.)

- For convenience, the following menu functions also now have dedicated pre-assigned computer keyboard short-cuts (which can be viewed via their respective menus):

  - *"Registration | Trigger master general combination | Master general cancel"*.

  - *"Registration | Cue/trigger/… stepper combinations | Trigger (jump to) frame 000"*.

  - *"Recording | Start recording audio/MIDI as armed"*.

  - *"General settings | General preferences"*.

  - *"General settings | MIDI/key triggers for menu functions and master pistons"*.

  - *"General settings | Audio mixer"*.

  - *"General settings | Audio mixer bus groups"*.

  - *"Organ settings | Organ preferences"*.

  - *"Organ settings | Rank routing to audio mixer bus groups"*.

- As for the audio settings screens, the virtual activity LEDs on real-time MIDI settings screens now have black backgrounds, so that it's easier to see when they're lit, and the duration of their flashes has been increased, so that it's easier to see their activity.

- A new general preference "*Reset transposer when organ resets?*" has been added. If not ticked, the previous state of the transposer will be recalled whenever an organ is reset (e.g. when when loading an organ). Please note: the preference defaults to ticked, whereas previous versions did not reset the transposer, so if you relied upon that behavior then you should un-tick the preference.

- A new general preference "*Reset stepper when loading a combination set?*" has been added, which defaults to ticked. The stepper current and cued frame numbers are always reset to 000 when an organ resets (e.g. when loading an organ), but this preference allows you to choose whether they should also reset when loading a different combination set. Hauptwerk v5 and earlier did not reset the stepper in that situation, whereas v6 did, so you might need to check or change the preference if you relied upon the behavior of a previous version.

- The "*Registration | Cue/trigger/increment/edit stepper combinations | Re-trigger current frame*" function has been added to the menu, and to the "*Registration*" and "*Combination stepper (all)*" large control panels, and to the "*Combination stepper 2*" mini control panel, and is also available for assigning to piston toolbar pistons. The function has actually existed continually since Hauptwerk v2, but was available only via MIDI in v4-v6 (for backward compatibility). It has been made more readily accessible again, for the benefit of those who might find it a more convenient, or easier to understand, way to programme the stepper.

- The default for the "*Cancel setter (capture mode) automatically whenever capturing to a combination?*" general preference has been changed to ticked, to help prevent accidentally overwriting combinations. (If upgrading, your existing setting for the preference will be retained unless you specifically reset general preferences to defaults.)

- The functions to increase or decrease the polyphony limit now support MIDI/key input (by right-clicking on their control panel buttons, for example), and can be assigned to piston toolbar pistons. Also, convenience functions have been added for incrementing/decrementing the polyphony limit setting by 1024, and for setting it to 1024.

- For convenience, *'Install* ...' and '*Uninstall* ...' buttons (which invoke Hauptwerk's component installer) have been added to the file browsers for selecting organs, temperaments, and impulse response reverbs. Also, if an organ is currently loaded it will no longer be unloaded automatically when installing/uninstalling a component, and you will not be able to uninstall the currently-loaded organ or temperament (to uninstall either of those you must first unload the organ, or load a different organ/temperament).

- On setting screens which have "*Advanced items*" nodes in their left-hand item lists, those nodes are shown expanded by default, so that the existence of those items is more immediately evident, and so that they may be navigated slightly more quickly.

- Sample set developers: a new organ definition attribute *ContinuousControl.MouseClickAndDragMode* is available, which optionally allows for more-native 'slider-type' behavior, and for horizontal orientation, when clicking/dragging with the mouse. For full details, please see the organ definition format documentation.

- Platforms: macOS 12 'Monterey' and Windows 11 are now also listed as supported.

- Documentation: a new section has been added to the user guide with step-by-step instructions for using Hauptwerk's stepper as a basic 'simple stepper' which just steps through a set of MIDI general pistons.

- Documentation: the previous "*MIDI sequencing | Composing pieces off-line from a MIDI sequencer configured conventionally …*" section in the user guide has been split into two and reworked to make them easier to understand:

  - "*Composing pieces off-line from a MIDI sequencer configured conventionally, method 1: using Hauptwerk's fixed, predefined MIDI implementation*". (This approach is recommend for convenience and simplicity.)

  - "*Composing pieces off-line from a MIDI sequencer configured conventionally, method 2: specifying your own MIDI implementation manually*".

- Performance: most real-time MIDI and audio settings screens now close much faster, and XML files load slightly faster.

- Performance: the settings screens now respond slightly more quickly in general.

- Performance: the time taken to stop audio/MIDI has been reduced a little, especially for larger organs, as has the time taken to start MIDI playback.

- Performance: MIDI output performance has also been improved a little.

- The audio and MIDI settings screens are now wider by default when opened initially, (only) if the lengths of the names of the items in their left-hand item browse lists require it in order to fit without truncation or scrolling, and if the computer screen's horizontal resolution is sufficient to accommodate the extra width.

- The default for the '*Extra time to allow when starting audio on Windows if not running at real-time priority*' advanced general preference has been reduced from 3 seconds to 0.

- Documentation: Focusrite has been added to the list of popular audio interface manufacturers in the Hauptwerk user guide, prerequisites, and background hardware technical information documents.

- Diagnostics: if the option to log MIDI events is enabled but no MIDI port is selected for the "*MIDI recorder/player external MIDI OUT*" port, then MIDI events that would have been sent to that port are no longer logged (thus helping to keep the log clearer and more compact). Also, MIDI feedback test messages are only logged for virtual 'Console MIDI OUT' ports/rows which have physical MIDI ports enabled.

- Diagnostics: upon launch, more comprehensive information is now logged for the topologies of connected computer screens.

- Diagnostics: more error details are now logged (including the column number) when an XML parsing error occurs.

- Diagnostics: the selected audio mixer preset is now logged whenever audio/MIDI stops.

- Various other minor cosmetic/usability improvements to settings screens, screen names, and menu/function names.

Bug fixes

- The text of the "*Free GB*" estimated usable remaining RAM figure on control panels could be very slightly truncated on computers with 100 GB or more of installed RAM (since v4). Please note: the "*Memory (RAM) usage*" mini control panel is now accordingly slightly wider than previously.

- The primary Hauptwerk window could be a very small number of pixels wider than 1024, potentially causing its extreme right-hand edge to be off-screen on 1024 pixel width monitors.

- A crash was possible if voicing was adjusted so that swell box filters, or voicing EQ filters, were extremely steep (since v2).

- Changes to MIDI port user alias sometimes wouldn't be refreshed on controls' settings and auto-detection screens until re-loading an organ or restarting (since v6.0.0).

- Settings screens could sometimes resize unnecessarily when changing certain settings (since v4).

- Custom Organ Design Module: previously (since v2), the _General.UniqueOrganID attribute only allowed a range of 800000-899999, whereas the format documentation stated that centrally-allocated OrganIDs (which would be outside of that range) could also be used, suitable for public distribution. To allow for that, the range has now been expanded to 1-999999 (as for 'full-format' organ definitions). N.B. if using an ID outside of the range 800000-899999 it must have been allocated to you by Milan Digital Audio, otherwise you risk breaking other publicly-released sample sets.

- Sample set developers: in the organ definition format documentation, a default assignment code wasn't specifically noted as having been newly-introduced in v5.0.0 (although the code itself was correctly listed).

- Custom Organ Design Module: the graph showing an example of a swell box filter's response on page 12 of the Custom Organ Design Module user guide was hiding some text in the PDF document.

Changes in version 6.0.2 above version 6.0.1

- Platforms: macOS 'Big Sur' versions 11.1 and later are now also listed as supported. (Please note that there are currently some minor compatibility issues with recent macOS versions, as listed in the '*Known issues*' section of this release notice.)

- Platforms: the Hauptwerk prerequisites have been updated to clarify that the only Macs officially supported at this point in time are those with Intel CPUs. (However, we understand that Hauptwerk does actually work satisfactorily on Apple's new Macs with Apple ARM-based CPUs, running under macOS' built-in Rosetta translator.)

- Bug-fix: since Hauptwerk v2, audio distortion/'popping' could occasionally be noticeable with certain bass pipes (depending on their samples, settings within their organ definition, and voicing settings) whose pitches were below 8' C at 96 kHz or 16' C at 48 kHz (although more probably only below about 16' C at 96 kHz or 32' C at 48 kHz). Please note that, in order to avoid the issue without significantly increasing CPU overheads further or affecting overall voicing, the wind supply and tremulant models no longer modulate the brightness of pipes below those pitches, and voicing settings adjusting their (dynamic) brightness modulation depths by the wind supply and tremulant models no longer have any effect (for pipes below those pitches only). This was felt to be the best compromise for now, since real tremulants affect the brightness of deep bass pipes minimally anyway, and amplitude and pitch modulations by the wind supply and tremulant models remain effective for them. (Note that the static brightness voicing adjustments continue to function as previously; it is only dynamic brightness modulations that are affected.)

- Bug-fix: if an organ was loaded and Hauptwerk's sample rate setting was changed without re-loading the organ then the harmonic-shaping (brightness) filters could have incorrect frequency responses (since v6.0.0).

- Bug-fix: since v4.0.0 an exceptionally unlikely circumstance existed whereby occasionally a pipe could consistently fail to be allocated a voice of polyphony (depending upon the sample set's number of pipes per key, number and triggering of constantly-playing sustaining/blower effects, and the number of CPU cores) after times of polyphony overload, affecting some recent sample sets from Piotr Grabowski.

- Bug-fix: when the Hauptwerk AU/VST Plug-in Link was used on macOS (only), with a host buffer size larger than the Hauptwerk buffer size setting, audio could occasionally hang (since v5.0.0).

- Bug-fix: if, for a given pipe, real-time reverb tail truncation was enabled via the voicing screen for more than one output perspective at a time then some of them could remain non-truncated for the pipe (since v5.0.0).

- Bug-fix: the 'HauptwerkReverb-SyntheticChapel01-Omni-3m-LR-1.5s' impulse response bundled with Hauptwerk wasn't compatible with a 96 kHz sample rate (since v5.0.0).

- Bug-fix: when resetting an organ, or loading a combination set, the 1s digit of the stepper cued frame number wasn't being reset to zero (since v6.0.0).

- Bug-fix: the buttons for 'route 4' on the 'Floating divisions' large control panel were incorrectly labelled as '1', although they worked correctly (since v6.0.0).

- Bug-fix: on macOS (only), menu items that opened Finder to show the contents of a folder weren't working if the folder's path containing space characters, which would usually apply only to '*Help | View/extract contents of a backup or diagnostic file*' (since v6.0.1).

- A work-around has been implemented for a performance issue in Windows 10 which could result in stopping audio/MIDI occasionally being very slow when running Hauptwerk at Windows real-time priority.

- MIDI/compatibility: MIDI ports whose names contain 'LP Mini', 'LPMini', 'LP Pro', and 'LPPro' are all now also considered to be Novation Launchpad devices.

- Installer/documentation: the installer and upgrading instructions in the user guide now specifically clarify that an existing installation will be upgraded correctly by default, regardless of whether the user chooses the 'Standard' or 'Custom' options in the installer.

- Documentation: the release notice and upgrading instructions in the user guide now specifically clarify that activating a v5->v6 Advanced Edition Perpetual license upgrade in iLok License Manager requires the v5 license to be 'surrendered' (exchanging it for the v6 license).

- Licensing: Hauptwerk v6 will now still consider a valid license to be present if, in the future, you have upgraded your v6 Advanced Edition perpetual license to a later major version and have surrendered the v6 license. This could be useful if you wished to upgrade your license to a later version and activate the resulting upgraded license, but not yet to install the later version of the software, or if you wished to retain your v6 installation on a separate computer/partition (or revert to v6) for any reason. (Please note that it remains the case that only one version of Hauptwerk can actually be present/installed at a time on any given computer operating system partition. It also remains the case that you would not be able to have more instances of Hauptwerk actually running at any given instant than you have licenses; after upgrading it to v7+ you would still need to surrender your v6 Advanced Edition perpetual license.)

- Sample set developers: the maximum allowed value for the organ definition attribute *Pipe_SoundEngine01_ReleaseSample.ReleaseCrossfadeLengthMs* has been increased to 10000.

- Documentation: some other minor corrections and clarifications have been made in the user guide.

Changes in version 6.0.1 above version 6.0.0

- Bug-fix: a licensing error could occur under some circumstances when loading sample sets (depending on the licenses present).

- Compatibility: PDF and HTML documents would sometimes fail to open specifically on macOS 11 ('Big Sur').

Changes in version 6.0.0 above version 5.0.1

'Favorite' organ, combination set, and temperament list changes, plus new 'utility functions menu'

- The number of 'favorite' organ, combination set, and temperament slots have been increased from 32 to 64.

- 'Favorite' organ, combination set, and temperament lists may now be edited, so that it's longer necessary to load another item in order to re-assign it to any given existing entry. (It's still necessary to load an item in order to assign it initially.) The following editing functions are available for each favorite type:

  - "*Insert blank list entry at cued*" (where 'cued' denotes the current cued favorite number).

  - "*Delete list entry at cued*".

  - "*Clear (blank) list entry at cued*".

  - "*Copy list entry at cued*".

  - "*Cut list entry at cued*".

  - "*Paste list entry (overwriting) at cued*".

  - "*Paste list entry (inserting) at cued*".

  They can be found on the following submenus (which have been renamed slightly accordingly):

  - "*Organ | Load favorite organ / edit favorites list*".

  - "*Registration| Load favorite combination set / edit favorites list*".

  - "*Pitch | Load favorite temperament / edit favorites list*".

  All of the new functions may also be triggered via MIDI, and/or be assigned to piston toolbar buttons. However, in order to avoid needing lots of additional MIDI pistons/buttons, as with loading/selecting/assigning favorites, there is also an equivalent set of editor functions for 'all types' of favorites.

  Additionally, there is also a new 'utility functions' menu system, which allows less commonly-accessed functions (such as editor functions) to be selected and performed using just three MIDI pistons/buttons (function selection up/down, execute selected function), with the currently-selected function being shown on the computer screen and/or on MIDI-controlled LCD panels. These new functions can be found on the following new control panels:

  - "*Cued favorites (all types) and utility functions menu*" large control panel.

  - "*Cued favorites (all types) list editor*" mini control panel.

  - "*Utility functions menu*" mini control panel.

  All of those 'favorites list editor (all types)' and 'utility functions menu select/execute' functions may also be triggered via MIDI pistons/buttons, and/or assigned to piston toolbar pistons, thus making it conveniently possible to edit favorites lists (and/or to select/execute other less commonly-used functions) from 'headless' MIDI consoles (without the need for a computer screen, keyboard, or mouse). To facilitate that, the following means are available for displaying the relevant information:

  - A new "*Utility functions menu cued function name*" LCD panel line format.

  - New *UtilityFunctionsMenuCuedFunctionCode* and *UtilityFunctionsMenuCuedFunctionName* MIDI console status output system variables.

Please note: for the most user-friendly interface if editing favorite assignments (including organ favorites) via a computer keyboard and mouse (as opposed to using MIDI pistons), we recommend having an organ loaded, so that the full complement of control panels may be accessed, then using control panels to perform the editing, such as the "*Cued favorites (all types) and utility functions menu*" large control panel, or the two "*Cued favorites (all types) …*" mini control panels. (Instead editing favorites via the menus is possible, but less convenient.)

- There are three new general preferences to define the maximum cued favorite slot numbers before the increment functions/pistons wrap back to 1 (for organs, combinations sets, and temperaments).

- There is a new general preference (which defaults to unticked) "*Last-used favorites remain lit if cued favorite numbers changed?*". If ticked, (for each of: organ, combination set, and temperament) the last-selected/assigned 'favorite' item remains ticked on the menu (and lit/on, if its slot is assigned to be triggered directly from a MIDI piston/button/switch), even if the cued favorite number has since changed.

- There are two new general preferences: "*Auto-load favorite combination sets when cued?*" and "*Auto-load favorite temperaments when cued?*" (both unticked by default). If ticked, cued favorite combination sets and/or temperaments load automatically as their cued favorite number is incremented/decremented. Note: used in that way, you could consider the favorite combination sets simply as 'memory levels', as found on some real/digital organs, with the increment/decrement pistons selecting the current 'memory level' directly.

Combination system changes

- The combination stepper now allows a full 3-digit frame number to be cued, with new '*cue +/-1*', '*cue xxN*', and '*trigger xxx*' functions available via the menu, control panels, piston toolbars, MIDI pistons, LCD panels, and the MIDI console status output system. This makes it possible to use the stepper to jump directly from one 3-digit frame to another without the need for so many pistons, if so desired. (For example, you could use the stepper conveniently (and in full) from just six MIDI pistons: '*+1*', '*cue -10*', '*cue +10*', '*cue -1*', '*cue +1*' and '*trigger xxx*'.)

- Based on a new general preference "*Stepper cue digit +/- pistons wrap to higher digits?*" (which defaults to ticked), stepper '*cue +/-1*' and '*cue +/-10*' functions optionally increment/decrement the higher digits when the ends of their ranges are exceeded, thus avoiding the need for additional MIDI pistons for the '*cue +/-100*' and/or '*cue +/-10*' functions, if so desired. For example, if the preference is ticked and frame 099 is currently cued, then pressing the '*cue +10*' piston will change cued frame number to 109 (instead of 009).

- MIDI-controllable pistons/buttons have been added for triggering stepper frames x00-x99. They work in the same way as the existing xx0-xx9 trigger pistons, except that there are 100 of them and they trigger the corresponding frame number within the cued 100s digit (ignoring the cued 10s digit). For example, pressing the x61 piston while 4xx (e.g. 453) is cued will jump to frame 461. They also potentially allow the stepper frames to be used as ten banks of 100 'generals', through which the stepper steps, if so desired (similar to a 'simple stepper', found on some pipe/digital organs, which just steps through the general pistons). All ten banks of ten are available via new mini control panels ("*Combination stepper xNN trigger pistons*"), and via a new "*Combination stepper (all)*" large control panel. They are also accessible via the Registration menu, and can be assigned to piston toolbar buttons.

- The number of MIDI-controllable master generals has been increased from 20 to 100. The first twenty are (still) included on the "*Registration*" large control panel, and all ten banks of ten are available via new mini control panels, and via a new large control. They are also accessible via the Registration menu, and can be assigned to piston toolbar buttons. (So as to maintain compatibility with existing MIDI files, only the first 60 can be triggered directly by MIDI program changes within Hauptwerk's MIDI player MIDI implementation.)

- There is a new general preference (which defaults to ticked) for last-used master generals and stepper trigger pistons to remain lit (and shown as current on any LCD panels), even if the current registration no longer matches their stored registrations.

- There are new general preferences "*Cancel setter (capture mode) automatically whenever capturing to a combination?*" and "*Cancel scope (range) mode automatically whenever scoping a combination?*" for whether to cancel SET and/or SCOPE automatically when capturing/scoping a combination.

- The combination stepper now has a comprehensive set of editor functions. The following functions are available via the (slightly renamed) "*Registration | Cue/trigger/increment/edit stepper combinations*" submenu:

  - "*Insert N blank frames at cued*" (where 'cued' denotes the cued stepper frame number).
  - "*Delete N frames at cued*".
  - "*Clear (blank) N frames at cued*".
  - "*Copy N frames at cued*".
  - "*Cut N frames at cued*".
  - "*Paste N frames (overwriting) at cued*".
  - "*Paste N frames (inserting) at cued*".

- o *"Increment editor block size by 1"*.

- o *"Decrement editor block size by 1"*.

- o *"Increment editor block size by 10"*.

- o *"Decrement editor block size by 10"*.

- o *"Set editor block size to N=1 frame"*.

- o *"Set editor block size to N=10 frames"*.

- o *"Set editor block size to N=100 frames"*.

- o *"Cycle editor block size N=1/10/100"*.

- o A set of 10 *"Set cued 1s digit=N (cued frames xxN)"* functions.

- o A set of 10 *"Set cued 10s digit=N (cued frames xNx)"* functions.

- o A set of 10 *"Set cued 100s digit=N (cued frames Nxx)"* functions.

The block size functions allow a block size 'N' to be selected, determining the number of cued frames upon which the various editor functions operate. For example, you could insert 100 blank frames simultaneously at the cued frame number by setting the block size to 100, then using the '*insert ...*' function. The copy/cut/paste functions also now make it possible for blocks of frames to be copied/moved (via the stepper editor's new clipboard) from one combination set (file) to another, whilst the organ remains loaded. For example, you could consider a block of 100 frames (say frames 100-199) as a template within a 'template' combination set (file), then copy/paste/reorder them into a separate combination sets for individual named pieces of music.

The '*set cued ... digit=N*' functions allow the 3-digit cued number to be 'typed' directly for speed via three rows of ten pistons/buttons.

All of the new functions may be triggered via MIDI, and/or assigned to piston toolbar pistons. They are also available via the following new control panels:

- o *"Combination stepper (all)"* large control panel.

- o *"Combination stepper 2"* mini control panel.

- o *"Combination stepper editor (all)"* mini control panel.

- o *"Combination stepper editor (basic)"* mini control panel.

There is also an additional new mini control panel:

- o *"Combination stepper xx0-xx9 trigger pistons"*

... for convenient use with the *"Combination stepper 2"* mini control panel, thus avoiding the need for the *"Combination stepper 1"* mini control panel also to be used for its xx0-xx9 trigger pistons (which would duplicate many of the functions from *"Combination stepper 2"* mini control panel unnecessarily, wasting screen space).

For detailed information about what each new function does, please either hover with the mouse over the relevant function button on a control panel (which shows pop-up 'tool tip' help), or consult the user guide.

For MIDI output/display (e.g. from 'headless' MIDI consoles) the following are available:

- o A new *"Stepper editor"* LCD panel line format.

- o A new *CombStepperEditorBlockSize* MIDI console status output system variable.

The editor functions can also be accessed conveniently (using just three MIDI pistons) via the new MIDI-controllable/display-able 'utility functions menu' (described in the preceding section in this release notice), which can be found on the following control panels:

- o   "*Utility functions menu*" mini control panel.

- o   "*Cued favorites (all types) and utility functions menu*" large control panel.

There is also a new general preference "*Prompt for confirmation before combination stepper edits?*", with options for "*Never prompt*", "*Always prompt*" (the default), and "*Prompt if block size is >1*". To avoid accidental edits, you may prefer to be prompted for confirmation before such edits are made. If using Hauptwerk 'headless' (with no computer mouse or keyboard), you should set this to "*Never prompt*".

When using the editor functions, it's important to remember that they operate at the cued frame number (not the current frame number). Hence you must set the cued frame number to the desired value, and make sure that the block size is set to the desired value, before performing an edit operation.

It's also important to be clear that the total number of stepper frames always remains at exactly 1000, and that frame numbering and ordering always remains unchanged (000, followed by 001, followed by 002, etc.). Inserting, deleting, cutting or paste-inserting frames simply moves the contents of existing higher-numbered frames up or down accordingly. Hence if, for example, you inserted one frame at frame number 228 then frame 228 would then become blank and frame 229 would contain the stored registration that 228 contained previously (and so on upwards, for all higher numbered frames); no additional frame (such as '228A' or '228.1') would actually be created between frame numbers 228 and 229.

- There is a new "*All pistons trigger stepper +1*" function (a.k.a. 'all pistons next'), accessible via MIDI, the "*Registration*" large control panel, the "*Setter, general cancel, hand registration and utils*" mini control panel, piston toolbars, and the "*Registration*" menu. When on, triggering any master combination piston (except for the setter, scope, master general cancel, stepper -1, and stepper 000 pistons) or optionally any organ divisional or organ general combination piston (depending on the following organ preference), increments Hauptwerk's stepper frame number (instead of the performing the piston's usual function).

   There is also a new organ preference "'*All pistons trigger stepper +1' mode only affects master combinations?*" (which is ticked by default, since some organs may have combinations that cause unexpected behavior if this option is unticked and "*All pistons trigger stepper +1*" mode is used).

   The MIDI console status output system has a new variable: *IsAllPistonsStepperPlus1ModeOn*, and the LCD system "*Combination states*" line format now also shows whether the system is in "*All pistons trigger stepper +1*" mode.

   (Please note that the "*Setter, general cancel, hand registration and utils*" mini control panel is now wider than before to accommodate the new button, so if you previously had it docked then you might need to reposition it within your screen layout.)

- *Important*: master scoped (ranged) pistons now behave differently if the setter and/or scope mode are turned on:

   - o   If both the setter and scope mode are on, then triggering a scoped piston will set its scope;

   - o   If the setter is on, but scope mode is off, then triggering a scoped piston will set its stored registration (within its currently-defined scope);

   - o   If the setter is off, but scope mode is on, then triggering a scoped piston will recall (show) its current scope;

- o   If neither the setter, nor scope mode, are on, then triggering the scoped piston will recall its stored registration (within its currently-defined scope).

- There are three additional MIDI-mappable inputs for the combination stepper '+1/increment' and '-1/decrement' functions, so that it's now possible to have up to ten distinct MIDI pistons for the '+1' function, and up to ten for the '-1' function.

- When loading a combination set the stepper cued and current frame numbers, the master crescendo, the last-used/lit master general (if any) and last-used master combination states sent via LCD panels and the MIDI console status output system, are all now reset.

- The existing "*Registration | Stepper (registration frame) general combinations*" submenu has been renamed to "*Registration | Cue/trigger/increment stepper frame general combination*".

- The existing "*Stepper +/- pistons also synchronize cued frame?*" general preference now affects all three digits of the cued stepper frame number.

MIDI changes

- The MIDI ports screens, and the way that MIDI ports are handled internally (and are auto-detected and stored for virtual controls) has been redesigned. Now, instead of (physical) MIDI ports being auto-detected/stored directly for virtual controls, there are 32 'logical' '*Console MIDI IN*' ports, and 32 'logical' '*Console MIDI OUT*' ports, and virtual controls auto-detect/store those. These 'logical' MIDI ports ('*Console MIDI IN/OUT*' entries) are shown as rows on the MIDI ports screen, with 'physical' MIDI ports (MIDI devices) shown as columns. Any row (logical MIDI port) may have at most one column (physical MIDI port) ticked, and likewise at most one row may be ticked for any one column.

  These grids of tick-boxes thus map 'physical' MIDI ports to 'logical' MIDI ports, so that if you subsequently change the physical MIDI interface/port to which a particular piece of MIDI hardware (MIDI keyboard, MIDI organ console, etc.) is connected, you can easily change the mapping (by simply changing which column is ticked for the relevant row) without needing to auto-detect MIDI settings again for all virtual controls that used the previous physical MIDI port. Likewise, if your computer unexpectedly renames any USB-MIDI devices (as can sometimes happen if you change any USB connections, especially if you have multiple USB-MIDI devices of identical makes/models connected).

  You can also (optionally, but recommended) give meaningful 'aliases' to each of the logical MIDI ports (rows) to identify the MIDI hardware that you have connected to them. For example, for "*Console MIDI IN 1*" you might specify '*My digital organ console*' if that's the MIDI hardware that you have connected to that particular logical port (row). Doing so makes it easier to see which logical MIDI ports (rows) connect to what, especially in case you need to change their physical MIDI port connections (or in case the computer unexpectedly renames the physical MIDI port) in the future.

  Any existing (Hauptwerk v5 or v4) MIDI settings will normally be migrated automatically. [**Important**: however, note that at most 32 MIDI IN ports (and at most 32 MIDI OUT ports) can be enabled simultaneously in Hauptwerk version 6+, so _before_ migrating to v6+ please ensure that you don't have more than 32 MIDI IN ports, or 32 MIDI OUT ports, enabled, otherwise any MIDI settings for the additional ports will be cleared during the migration, with corresponding warnings logged.]

- All Hauptwerk master pistons and other menu functions that were previously auto-detected/configured on a per-organ basis may now alternatively be auto-detected/configured globally (for all organs), or per-organ (as before). Right-clicking on a control panel button or piston toolbar piston presents menu options for each method. This avoids the need for you to auto-detect master pistons/functions separately for each organ individually, in case you prefer to use the same MIDI pistons for those purposes for all organs.

  Also, the corresponding screen on the "*General settings*" menu has been renamed accordingly to "*General settings | MIDI/key triggers for master pistons and menu functions (for all organs) ...*", and, likewise, the option on the General Configuration Wizard to reset those settings has been renamed. Clearing settings for any given virtual control clears them at both levels.

  (Diagnostics: also, whenever a virtual control is auto-detected, Hauptwerk logs whether it has been auto-detected on a per-organ basis, or for all organs.)

  [Note: in v6 it was necessary that any given MIDI control (physical MIDI switch/stop/piston, etc.) or computer key was assigned _either_ to a global ('for all organs') function _or_ to a per-organ ('for this organ') function, _but not to both_, so as to avoid both assigned functions potentially being triggered. However, in v7+ that restriction is no longer necessary, since per-organ MIDI assignments can optionally override global assignments; please see the v7.0.0 changes section for details.]

- All LCD panel line formats that were previously available only via the "*Organ settings*" menu, are now also available via the "*General settings*" menu, to avoid the need for you to configure LCD panels separately for each organ unless you specifically want to customize them on a per-organ basis. (The only exceptions are the "*Organ expression pedal/slider/knob ...*" and "*Fixed, user-defined label text*" line formats, which are inherently organ-specific, and so remain per-organ only.)

Audio engine changes

- There is a new organ preference "*Audio engine | Real-time audio pitch-shifting quality*". The "*Standard*" option uses the same quality pitch-shifting (interpolation) as previous versions, but there is also a new "*Higher definition*" option. Higher-quality pitch-shifting is more CPU-intensive (and requires slightly more memory), sacrificing achievable polyphony (typically about 50%) for higher audio definition. However, it gives significantly better signal-to-noise ratio (much less distortion, and better clarity), which may be noticeable and is always beneficial, but especially so for larger pitch shifts and deep tremulants. It is recommended if you have sufficient spare computer processing power.

  To hear the difference that the setting makes, try playing a single pipe whist raising and lowering the pitch slider on the *Pitch* large control panel. With the "*Standard*" option you may hear some distortion appear as you raise/lower the pitch (even though the pitch change is less than a semitone), which the "*Higher definition*" option avoids. (Some pipes/ranks may show it more clearly than others.)

  [Please note: the preference has been renamed to "*Audio engine processing quality*" in Hauptwerk v7+, and in v8+ only its 'lower' and v7+ 'higher' options are available, with the v6-equivalent '*medium*' option having been removed.]

  There is also a new "*Sample rate (for audio engine and audio output)*" setting on the "*General settings | Audio device and channels*" screen, which contains options for 48 kHz (the default), 96 kHz, and "*Use organ's default sample rate*". The latter gives the same behavior as previous Hauptwerk versions. The new 96 kHz option is more CPU-intensive, sacrificing achievable polyphony (typically about a further 50%) for higher audio quality. It gives better signal-to-noise ratio (less distortion, and better clarity), especially for larger upward pitch shifts and deep tremulants (which might otherwise introduce 'aliasing' distortion). (It also has other smaller sonic benefits, even if not raising the pitch.) It is recommended, especially if you raise the base pitch of any organs, provided that you have ample spare computer processing power. The same sample rate will be used for audio output and audio recording, to avoid any further slight distortions that would occur by down-sampling.

  To hear the difference that the setting makes to aliasing distortion, try raising an organ's base pitch to 600 Hz and then play a scale on a pure high-pitched rank (such as a flute rank); you will probably hear strange dissonant 'aliasing' tones on some (seemingly arbitrary) high notes without the 96 kHz option. As well as the degree to which the pitch is being raised, how beneficial it is also depends on where the sample set producer has applied an anti-aliasing filter within the samples. Hence, without the 96 kHz option, for some sample sets aliasing might occur even with smaller pitch increases.

  (Real-time per-pipe anti-aliasing filters aren't used in Hauptwerk, since the CPU overheads of doing so would be about as much as simply running the audio engine at 96 kHz, whilst 96 kHz also gives other sonic benefits.)

  If you choose both the "*Audio engine | Real-time audio pitch-shifting quality: Higher definition*" organ preference and the "*General settings | Audio device and channels | Sample rate: 96 kHz*" options then achievable polyphony is likely to be about 75% less than Hauptwerk version 5 (but audio quality will be noticeably higher than any previous version).

  The first time that you load any given organ in Hauptwerk v6, the Organ Configuration Wizard will run to ask you how you prefer the "*Audio engine | Real-time audio pitch-shifting quality*" preference to be set. (For installations upgraded from a pre-v6 version, the preference will default to its 'standard quality' option, for the same performance as v5, but for new installations higher-quality pitch shifting is selected by default.)

  (Please note that if you use the Hauptwerk AU/VST Link for audio output, then you should ensure that your AU/VST host project's sample rate corresponds to whatever value you select via the "*Sample rate (for audio engine and audio output)*" setting on the "*General settings | Audio device and channels*" screen.)

- Other minor sonic and fidelity improvements have been made.

Other changes

- "*Advanced audio ...*" submenus have been removed from the "*Organ settings*" and "*General settings*" menus, with their items moved up a level. Likewise, the items that were on the "*General settings | Advanced MIDI ...*" menu have been moved up a menu level, and the LCD panel screen on the "*Organ settings | Advanced MIDI ...*" submenu has been moved up a level. (This also ensures that the menus display properly on recent macOS versions within a horizontal screen resolution of 1024 pixels.)

- An organ's cache file is no longer marked for regeneration in the specific circumstance that a license for it is temporarily unavailable (e.g. due to an Internet connection interruption if using iLok Cloud).

- Performance: the performance of background models and pipe key processing have been improved slightly.

- Audio: Hauptwerk has been made compatible with the behavior of the MOTU AVB Windows ASIO driver when changing its sample rate between 96 kHz and lower values.

- Audio: Windows ASIO drivers that change the numbers of channels they present when changing sample rates between 96 kHz and lower values are now handled without the need to re-launch Hauptwerk.

- Audio: the "*Disable interpolation (use fixed-pitch sample play-back)*" organ preference has been removed (now that very high-quality pitch shifting is available, and since the existence of the preference had a slight impact on achievable polyphony even when not ticked). (Sample set developers: the corresponding *_General.AudioEngine_EnablePlayingWithoutInterpolation* organ definition attribute has also been removed.)

- MIDI: the names of all LCD line formats have been clarified (but the text that they display on LCD panels remains unchanged, except for the addition of the 'all pistons next' indicator to the "*Combination system states*" line format, as covered previously.)

- MIDI: previously, if a combination set was longer than 12 characters, it was truncated to 10 characters, with '..' appended, when displayed on LCD panels. Now it is instead simply truncated to 12 characters (thus effectively allowing two extra characters to be used).

- MIDI: to help avoid confusion, the General Configuration Wizard has been changed so that selecting a hardware console type of either "*I don't yet have any MIDI hardware*" or "*I won't be playing Hauptwerk live; only controlling it from a sequencer*" no longer in itself causes any MIDI settings to be reset. Also, if one of those options is selected then the MIDI ports wizard page(s) are still shown.

- MIDI: the '*General settings | MIDI ports*' screen and General Configuration Wizard are now also resizable on macOS (as they were previously on Windows), so that they can be made larger if desired, especially for users with many MIDI ports.

- Sample set developers: exporting to a SQLite database is now much faster (especially on Windows, which previously was slow). Timing is also now logged, for diagnostic purposes.

- A progress indicator is now shown whilst the "*General settings | Audio device and channels*" screen is being opened, since it could take a few seconds to appear.

- Diagnostics: brief summary results of each MIDI auto-detection event are now always logged, even if the advanced general preference to log MIDI is not ticked (whereas previously they were only logged if the preference was ticked). Also/likewise, summary auto-detection results are logged when auto-detecting MIDI to ranks directly (previously they were never logged, irrespective of the preference).

- Diagnostics: if an error occurs while attempting to add a file to a backup, more comprehensive details are now logged.

- Diagnostics: messages are logged to indicate when settings screens have been OKd after settings have been changed on them. (The exception is the MIDI ports screen, since any changes made there will be evident from other log entries.)

Bug fixes

- The pitches at which harmonic-shaping filters were being applied weren't taking into account any non-default user-specified base-pitch adjustments, or other user-specified tuning (overall, or per-pipe) adjustments (since v4.0.0). Please note that if you had adjusted an organ's tuning significantly from its default then this may slightly affect overall sound (compared to v4-v5), perhaps making some voicing tweaks (e.g. to pipes' 'brightness') desirable to compensate.

- Cancelling the "*Do you want to save your current combinations?*" prompt would cause the background models (wind, tremulants, etc.) to hang (since v4.0.0).

- Bug-fix: if an impulse response reverb file was invalid due to its sample rate being incorrect then the error message (ERR:2492) that Hauptwerk (correctly) logged could fail to report the required rate correctly (since v5.0.0).

- The presence of an invalid zero-length source file (e.g. a configuration, combination, or database file) would prevent a backup from created (since v3).

- If an error occurred when trying to add a file to a backup, the error message (ERR:0055) could fail to show to show the backup filename.

- Some spurious progress indicators that would normally be open behind other user screens/prompts have been removed, since they caused problems on a few computers/platforms whereby occasionally they could somehow end up in front of the window awaiting user interaction.

- Combination elements for which the sample set creator didn't specify memory switches, and didn't designate their combinations as allowing capture, would incorrectly always default their initial states to disengaged, even when their default states were specified as being engaged (since v4.0.0).

- Custom Organ Design Module (CODM): since v5.0.0, across the compass of any given rank, the virtual pipe diameters (and thus normal flow rates) were unintentionally being compiled to slightly different values compared to Hauptwerk v4. They were still valid, and this would have had no adverse effects for the user of the compiled custom organ definition, but the CODM has been changed to compiled them to the same values that v4 would, for consistency.

- Sample set developers: certain values in an organ definition that were invalid due to violating a unique key could fail to be reported in an (unusual) circumstance when loading the organ via "*Design tools | Load organ with design options*" (since v2).

Changes in version 5.0.1 above version 5.0.0

- Compatibility: the proportion of RAM that Hauptwerk v5.0.0 asked Windows to allow it to use resulted in stability problems on a few Windows 10 PCs. The amount of RAM that Hauptwerk always avoids using has also been increased a little, to reserve a little more for the operating system, drivers, background processes, etc.

- Bug-fix: Hauptwerk could freeze if the demand for instantaneous polyphony exceeded the number of free voice generators (i.e. if the polyphony demand would completely overload the polyphony limit setting).

- Bug-fix: Hauptwerk could crash when starting audio/MIDI with certain sample sets if the Hauptwerk AU/VST Link was selected for audio (but not MIDI) output.

- Bug-fix: Hauptwerk would freeze if stopping audio recording if the 'prompt for filename' option was ticked and the 'record MIDI' option was not ticked.

- Bug-fix: a click could be audible with certain pipes when cross-fading to release samples (especially if the harmonic-shaping/brightness filters were turned up significantly).

- Bug-fix: a crash occurred on a few computers when exiting Hauptwerk after successfully performing any of the following: restoring a backup, reverting all settings to factory defaults, cancelling launching Hauptwerk if any audio/MIDI devices were missing, or via '*Exit*', '*Shut computer down*' or '*Re-start computer*' from the File menu.

- Memory usage for the Advanced Edition's audio mixer/routing has been significantly reduced, compared to v5.0.0. (However, when audio/MIDI is active, v5 does still need to use a bit more memory than v4 for its voice generators, which are 8-channel surround-capable in v5 whereas v4's were stereo.)

- Compatibility: since a few PCs have performance/stability issues if running Hauptwerk at real-time priority, the '*Try to run Hauptwerk at real-time priority on Windows*' advanced general preference now defaults to un-ticked. (However, running at real-time priority does give more reliable and better audio/MIDI performance on most PCs.)

- Compatibility: very large values in organ definitions for inertia linkages' acceleration/damping that yielded numeric overflows were being handled differently in v5.0.0 compared to v4, resulting in Inspired Acoustics' native combination steppers not working. Inertia linkages have now been changed to yield the same results in such circumstances, for compatibility with those sample sets.

- Platforms: macOS 10.15 is now listed as supported. However, please note that there are currently some known minor compatibility issues, which are listed in the '*Known issues*' section in this release notice.

- Bug-fix: a crash (or menu action being ignored) was possible with a particular (unusual) combination of settings when stopping audio.

- Bug-fix: a crash was occasionally possible (since v3) if clicking the OK button multiple times on a settings screen immediately after changing a drop-down setting that enabled/disabled other settings on the screen (as the v5 '*General settings | Audio device and channels*' screen's audio device setting does if changing between two devices of different driver types).

- Bug-fix: any pipes' perspectives routed to empty audio mixer bus groups would incorrectly sound through audio mixer primary bus 1.

- If audio settings have been migrated from Hauptwerk v4, newly-installed organs' ranks are now routed by default to the migrated v4 default audio mixer bus group (provided that the group is still non-empty).

- To help avoid confusion, when the General Configuration Wizard runs automatically upon first launch after upgrading from a pre-v5 version, the (recommended) options to discard/reset migrated Hauptwerk v4 audio settings/routing are no longer ticked by default if you previously had more than one audio output group configured in your previous Hauptwerk version. Likewise for the option to reset (migrated)

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rank routing when the Organ Configuration Wizard runs automatically when first loading each organ after upgrading from a pre-v5 version. Also, the 'enable MIDI output' option on the General Configuration Wizard now defaults to 'yes' if any MIDI OUT ports were previously enabled for console MIDI output. Also, the '*Assorted MIDI or USB music keyboards/synths*' MIDI hardware console type has been changed to allow MIDI output (so that it behaves in the same way as the '*DIY/home-made or modified MIDI console*' console type). Also, a note has been added to the General Configuration Wizard to emphasize that saying 'no' when asked whether to enable MIDI output will clear MIDI settings for any virtual controls for which MIDI output is already configured.

- For convenience (and consistency with Hauptwerk v4), the '*All perspectives: overall amplitude (dB)*' adjustment is now selected by default on the '*Organ settings | Rank voicing ...*' screen.

- For convenience, when loading a newly-installed organ for the first time, if the default audio mixer bus group (group 5: 'Front 1/main', with default settings) has since been emptied by the user, then output perspective 1 of each of the organ's ranks is now routed by default to the first non-empty group (excluding groups 2-4, which are used for surround/3D audio with default settings).

- The default for the '*Extra time to allow when starting audio on Windows if not running at real-time priority*' advanced general preference has been reduced from 7 seconds to 3. (As with v5.0.0, you can still set the setting to 0, for no delay, if you prefer.)

- The '*Console Windows Size*' mini control panel is now positioned at the bottom (instead of the top) of the main window when no organ is loaded (as it was in Hauptwerk v4), to keep the width of main window less than 1024 on macOS, especially for compatibility with portrait-orientation 1920x1080 touch-screens.

- The maximum MIDI note for bass splits on the Rank Routing to Audio Mixer Primary Bus Groups screen increased from 60 to 84.

- An 'x' close-window button has been added to the title bars of the two voicing screens on Windows (in addition to the existing 'Close' button, and keyboard shortcuts for closing the window), for consistency with macOS and Hauptwerk v4.

- Whilst an organ is loading, triggering any of the functions via MIDI to change/select the cued favorite organ, select a recent organ, or change/select the cued favorite object (of all types), now cancels the organ loading (as was technically possible in v4).

- Bug-fix: organs that specified original organ pitches outside of the range 380-500 Hz (as with Piotr Grabowski's recent Erfurt sample set) would sometimes give a confusing error message (since v4.0.0). The range of the user 'Base pitch Hz' setting has now been expanded to 300-600 Hz (the same as the allowed range for the corresponding organ definition original organ pitch attribute) to avoid that.

- Bug-fix: switching off an organ's virtual blower switch (if available) could result in played pipes continuing to be audible after the wind pressure had fallen to zero.

- Diagnostics: a more-detailed error message is now reported if an operation fails due to the active connection to iLok Cloud or an iLok dongle having been lost.

- Diagnostics: memory usage statistics are logged whenever stopping audio/MIDI or creating a diagnostic file. Additional memory statistics are also logged on Windows.

- The installation/upgrade instructions sections in the user guide have been expanded.

- Compatibility: for Macs, by default, Hauptwerk's installer is now provided for download within a .ZIP file (instead of a .DMG file), to try to make it easier for those wishing to try using Hauptwerk on older macOS versions that are less than the minimum officially supported version of macOS 10.13.6. (Please note that Hauptwerk version 5 will definitely not work on OS X version 10.10 or earlier.)

- The set of Hauptwerk licensing packages (current at the time that the Hauptwerk version was built) are now installed included within, and automatically installed by, Hauptwerk's installer, to try to maximize the

chances of Hauptwerk being able to load any given licensed sample set for people who accidentally omit the step in the installation instructions to install them. (However, it's still important to follow that installation instruction step, since additional packages for new sample sets may have been released since this version of Hauptwerk was built.)

- Various other minor changes and fixes.

Changes in version 5.0.0 above version 4.2.1

(Please note: where menu names have changed for subsequent v6+ versions, the new v6+ menu names are shown in the following.)

Advanced Edition only: audio routing, multiple audio output perspectives, and associated voicing changes

Hauptwerk's audio routing, and associated settings screens, have been re-designed from the ground up to be massively more powerful and convenient to use.

(With the exception of changing the main audio driver itself, or its settings):

- All audio/routing settings changes can be made fully in real-time without re-starting audio/MIDI.

- Audio/routing settings changes take effect and can be heard immediately.

- Audio/routing screens show real-time visual feedback so that it's easy to see what's being routed where as you play or change settings.

- The audio/routing settings screens can be open and used simultaneously, so that you can immediately see how changes made on one screen affect any other.

- Audio/routing screens allow multi-selection, so that you can change the settings quickly for multiple objects at once.

Also:

- (As covered separately in the next section) very high-performance impulse response reverb can be applied natively within Hauptwerk, without any third-party software or hardware needed.

- **Hauptwerk's default audio routing settings are pre-configured so that surround/3D-sound, adding overall reverbs, sub-woofer mixes, and stereo recording mixes require just a very few clicks to configure, with no need to use or understand Hauptwerk's underlying multi-channel audio functionality or associated screens. For any of these purposes, make sure you reset your audio routing settings when prompted when you first run Hauptwerk v5, then simply follow the instructions on the '*General settings |Audio mixer*' screen to select the appropriate device channels for the relevant 'master mix' buses (and optionally to select reverbs for them), and (for surround/3D-sound) then use the '*Organ settings | Voicing and surround/3D/perspective* panning' screen's '*Perspective mix: …*' adjustments to pan ranks to your surround/3D speaker pairs**.

- **You can optionally configure up to 8 independent 'mixer presets' (complete sets of global audio routing and impulse response reverb settings) and apply different ones to different organs (via the *'Organ settings | Organ preferences*' screen)**.

- **You can also adjust (scale) the 'wetness' of any impulse response reverbs you might have applied on the mixer overall, on a per-organ basis, via the new '*View | Large … control panels (for this organ) | Audio … settings*' control panel. This provides a very simple and quick means to tweak reverb wetness, and/or disable reverb, on a per-organ basis.**

- Virtual pipe ranks can be panned in real-time amongst the stereo pairs within surround/3D speaker set-ups, and voiced separately for those pairs.

- (As covered separately in the voicing section) the rank voicing screen now allows multiple ranks to be voiced/routed/panned simultaneously.

- It's now possible even for very complex audio routing to be configured quickly, in real-time, and much more easily.

- Changing an audio routing setting will never now cause an organ to re-load, or for its data cache to be regenerated.

In order to take best advantage of Hauptwerk v5's capabilities, we strongly recommend resetting your audio configuration when prompted when first launching v5, and then adjusting/configuring it as desired (although any existing v2/v3/v4 audio settings will be migrated where possible if you don't choose that reset option). If you do wish to migrate your v2/v3/v4 audio settings then please make sure that your audio interface is connected and turned on before launching v5 for the first time, so that its channels can be queried as needed for the migration. The '*General settings | General configuration wizard*' and '*Organ settings | Organ configuration wizard*' functions may also be used to reset audio routing back to defaults.

The audio device/driver is now selected via the new '*General settings | Audio device and channels*' screen. The screen optionally allows you to rename or remap channels, and has a new option for additional internal audio buffering, which might help on some PCs prone to audio glitches. Only a single device/driver can now be in use (which is necessary to ensure audio synchronization), but Windows ASIO devices and Mac CoreAudio devices with up to 1024 channels are now supported (although only the first 128 allow renaming/remapping on the '*General settings | Audio device and channels*' screen). (Windows DirectSound drivers aren't recommended, since they don't usually perform as well, and they only allow a single pair of channels in Hauptwerk.) *[*]*

By default, audio routing settings are configured with appropriate mixer buses and groups for basic stereo output, as well as for 2D-surround (front and back stereo pairs of speakers) and for 3D-surround output (front/back upper/lower stereo pairs), and for multi-channel output with four pairs of speakers in the single (main) group, so that everything is defaulted appropriately for basic stereo output, and simultaneously also for surround output, and simultaneously also for four-stereo-pair multi-channel output. This makes it extremely quick and easy to configure Hauptwerk for those purposes, as well as for applying overall impulse response reverbs, avoiding any need to use or understand most of Hauptwerk's routing or multi-channel audio screens or settings.

There are eight independent and complete sets of mixer/group settings for the '*General settings | Audio mixer*' and (for multi-channel audio) '*General settings | Audio mixer bus groups*' screens. These independent sets of settings are termed 'mixer presets', and can be found and configured via the left-hand browse lists on those screens. You can select which of the eight mixer presets should apply to each individual organ via the '*Organ settings | Organ preferences | Audio mixer preset*' screen tab. This allows you to apply different audio routings and impulse response reverbs to different organs. For example, you could set up one preset for wet stereo organs, another for wet surround organs, and another for dry organs (for adding impulse response reverb). [Unlike Hauptwerk v4, it is no longer necessary to use the '*Hauptwerk (alt config N)*' desktop shortcuts for that purpose.]

As always, the on-screen help on each of the new screens provides more detailed information and hints. For convenience, there's also a new '*Audio Mixer, Routing and Voicing/Panning Settings*' large control panel (available via the View menu) for opening the relevant screens, as well as convenience buttons on the relevant screens themselves to show the others that relate to them. As mentioned above, the new control panel also allows you to adjust (scale) the 'wetness' of any impulse response reverbs that you might have applied on the mixer overall, on a per-organ basis. This provides a very simple and quick means to tweak reverb wetness, and/or disable reverb, on a per-organ basis.

Please consult the '*Audio routing and impulse response reverb*' sections in the main Hauptwerk user guide (on the Help menu in Hauptwerk) for full details about Hauptwerk's new audio routing capabilities and how to use them, including step-by-step tutorials for the most common modes of use (including 2D/3D surround, multi-channel audio, etc.).

The remainder of this section describes in detail the changes relating to multi-channel audio (whereby ranks are distributed automatically or manually amongst multiple speakers for purposes other than surround/3D-sound). **You can skip all of the following unless you plan to use multi-channel audio specifically**:

Central to the new design are the new *'General settings | Audio mixer ...'* screen (which replaces Hauptwerk version 4's *'General settings | Audio outputs'* screen), and the new *'General settings | Audio mixer bus groups ...'* screen (which replaces Hauptwerk v4's *'General settings | Audio output groups'* screen).

(Similar to Hauptwerk v4), the core underlying concept is that virtual pipe ranks are routed via groups to primary mixer buses, and that mixer buses may output audio to audio device channels and/or to other 'mix buses' (akin to aux sends routing to aux buses on a mixing desk). Ranks are now routed to groups using the new *'Organ settings | Rank routing …'* screen (whereas in v4 the *'Organ | Load organ, adjusting rank …'* screen needed to be used prior to loading an organ). The screen can usually also be reached be right-clicking on the desired stop on the virtual console.

It's now also possible optionally to route any given pipe rank to up to four different groups simultaneously using the four new 'output perspectives' on the (renamed) *'Organ settings | Rank voicing and surround/3D/perspective panning'* screen, and the corresponding 'output perspective' settings on the *'Organ settings | Rank routing …'* screen. The new *'Perspective mix: source … to output … 1-4 …'* voicing adjustments are used to route the output from any given pipe rank to any or all of the four 'output perspectives', and the four perspectives may be voiced independently. These output perspectives would normally be used for (and are configured by default for) surround/3D-sound use, allowing you to control the mix sent from each virtual rank/pipe to each of your surround/3D set-up's stereo speaker pairs (front/main, front/upper, rear/main, rear/upper), thus effectively positioning the rank virtually within the your listening room, optionally also voicing it differently for the various speaker pairs. (Alternatively, for example, you could use one of the perspectives for a rear 'reverb' mix, adjusting the levels and voicing sent to it independently for each rank.) For surround/3D sound use it is thus no longer necessary to route ranks manually to separate groups – instead (with the default audio routing settings) you simply pan each virtual rank as appropriate via the voicing/panning screen.

(For each mixer preset) the audio mixer has a fixed number of 1024 'primary buses' (to which ranks can be routed, via groups), 8 'intermediate mix buses', and 8 'master mix buses'. It allows primary buses optionally to be routed to any or all of the mix buses (of either type), and the 'intermediate mix buses' optionally to be routed to any or all of the 'master mix buses'. For example, you might route some ranks to a group of several stereo speaker pairs, whilst simultaneously sending the audio from all of those pairs' primary buses to a mix bus used for adding reverb.

All mixer buses are stereo, but you can still choose to load ranks in mono (via the *'Organ | Load organ, adjusting rank audio memory options'* screen). You can also output any or all buses to any stereo pair of audio device channels (speaker pairs), or to mono device channels (speakers). Hauptwerk's built-in audio recorder can also record any or all mixer buses (in stereo).

It's now possible for any primary mixer bus to be a member of more than one bus group, and to include any given bus in multiple groups, and any given audio device channel may be used for any number of mixer buses.

As with Hauptwerk v4, when a rank is routed to a group that contains more than one bus, a 'bus allocation algorithm' is used to define how individual pipes in the rank get routed to the individual mixer buses within the group. However, unlike v4, the algorithms can now be specified at the per-rank level (instead of the per-group level), via the new *'Organ settings | Rank routing …'* screen, thus allowing different algorithms to be used for different organs and/or ranks when routing to any given group, if so desired.

There are also a number of new algorithms, including 'dynamic' ones, which allocate pipes to mixer buses in a group on a per-key-press basis, such that any given pipe is allowed to move around within the group for subsequent key presses. (Dynamic algorithms might not strictly be realistic acoustically, but they do potentially allow more even load balancing for any given number of speakers.) It's also now possible to specify algorithm note offsets manually, so that (for non-dynamic algorithms) you have full control over which pipe in a rank will end up being allocated to which specific mixer bus/speaker, whereas previously that was usually determined by the creator of the organ (sample set) being used. As with Hauptwerk v4, the lower/bass part of any given rank may optionally be routed differently from its upper/main part.

To help familiarize yourself with the way the new multi-channel audio routing works, with an organ loaded, we recommend opening all of the following screens at the same time:

1. '*Organ settings | Rank voicing and surround/3D/perspective panning*'.

2. '*Organ settings | Rank routing …*'.

3. '*General settings | Audio mixer bus groups …*'.

4. '*General settings | Audio mixer …*'.

Conceptually, a pipe/rank's audio flows through all of those screens in the order above, i.e.:

Rank voicing/panning -> Rank routing to audio mixer bus groups -> Audio mixer bus groups -> Audio mixer

(… and then to the '*General settings | Audio device …*' screen.)

With a single stop drawn, play different notes and watch how the virtual activity LEDs flash down the left-hand sides of the (last three) screens to see how pipes are being routed as you play, and as you change settings on the screens. (Please note that the activity LEDs on the '*Organ settings | Rank routing …*' and '*General settings | Audio mixer bus groups …*' screens only flash momentarily as you press each key, whereas those on the '*General settings | Audio mixer …*' remain lit whilst a bus is receiving any audio signal.)

[Please note that when loading any given organ for the first time in Hauptwerk v5+, the organ's internal data cache will need to be (re-)generated, which might be slow, but subsequently the organ should load faster.]

[* Please also note that technically Hauptwerk v5's audio configuration also has the following limitations compared to v4: a maximum of 16 total mixer 'mix' buses (the equivalents of v4's aux mix-down outputs) is allowed, and the left and right device channels selected for any given mixer bus (v4 audio output) when stereo should usually be consecutive (although if you really want to use non-consecutive channels then channel orders can be remapped manually via the 'General settings | Audio device and channels' screen).]

Advanced Edition only: native impulse response convolution reverb

Hauptwerk now has a native, very high-performance impulse response convolution reverb engine built in, allowing high-quality real-time reverb to be added easily and natively, with no additional hardware or software needed.

It's a 'true stereo' (four-channel) convolution reverb engine, and is designed to be able to handle large numbers of simultaneous instances with low CPU load (especially with modern multi-core CPUs that support AVX CPU instruction sets), thus allowing realistic 'virtual acoustics' optionally to be configured (with many virtual sound sources to distribute pipes/ranks within virtual space). In fact, for small organs, and with a powerful computer, even per-pipe convolution (with a separate impulse response applied for each pipe's mixer bus individually) should be possible. In itself, Hauptwerk's reverb engine adds no additional latency (sound delay).

A selection of high-quality impulse response reverbs is included (pre-installed) with Hauptwerk, and additional impulse response reverbs can be installed using '*File | Install …*' within Hauptwerk. They need to be in Hauptwerk format, and we anticipate that plenty of reverbs will be available from sample set developers and others over time. (Sample set/reverb developers: please use the new '*Design tools | View ... reverb format documentation*' menu function in Hauptwerk for details of the necessary format.)

Once installed, you can apply any reverb to any of the buses on the '*General settings | Audio mixer*' screen. For example, for basic use, you could just apply a single reverb to Hauptwerk's overall stereo output via an appropriate 'master mix bus', or for more complex use you could apply different reverbs to individual mixer buses.

Reverb wet/dry mix, wet level, and wet pre-delay may all be adjusted via the mixer screen. An impulse response reverb may also optionally be faded out (truncated), to help reduce CPU load and/or to help make it seem 'drier'.

As mentioned in the previous section, you can also adjust (scale) the 'wetness' of any impulse response reverbs you might have applied on the mixer overall, on a per-organ basis, via the new '*View | Large … control panels (for this organ) | Audio … settings*' control panel. This provides a very simple and quick means to tweak reverb wetness, and/or disable reverb, on a per-organ basis. 'Mixer presets' can also be used to set up different reverbs for different organs.

Licensing changes

- Hauptwerk is now licensed via the PACE iLok system (instead of the 'Hauptwerk USB key' HASP dongle that was used for v4).

- To use or evaluate Hauptwerk, you need to have/create an account on https://www.ilok.com/, and to have installed the current version of iLok License Manager, which may be downloaded there. iLok License Manager is used for viewing/activating/deactivating/transferring/renewing licenses, as well as for logging into/out of iLok Cloud (see below). Some commercial Hauptwerk sample sets are also licensed via the iLok system, and licenses for them may viewed/activated/deactivated/transferred/renewed in iLok License Manager, in the same way as for licenses for Hauptwerk itself. Whenever you have been sent an activation code for a license purchased (whether for Hauptwerk, or for a sample set), you can enter it in iLok License Manager using '*Licenses | Redeem Activation Code'* (then exit and re-launch Hauptwerk, if it was running).

- You can choose to use any given license in either of two ways:

   o The license may be activated to an **iLok3/iLok2 hardware USB dongle**. This method requires no permanent Internet connection to the Hauptwerk computer, since licenses within the dongle may be activated/deactivated/transferred (and renewed, in the case of subscription licenses) by temporarily moving the dongle to a separate Internet-connected computer (which has the iLok License Manager software installed) whenever needed. The dongle may be moved freely around amongst several computers, provided that the dongle is attached to whichever computer has Hauptwerk running at the time. (Please make sure that you never attach or detach the dongle whilst Hauptwerk is actually running.) Hauptwerk will not run without the iLok dongle containing the Hauptwerk license attached. A dongle is the required 'licensing location' for computers that do not have a reliable always-on Internet connection (such as for most church installations, or for PCs for which an Internet connection is not used in order to avoid audio glitches). **An iLok dongle is not provided with a Hauptwerk license**, **but iLok3 dongles may be purchased readily from musical equipment shops**. If you already have an iLok2+ dongle then you can also use that dongle for Hauptwerk; licenses for multiple software products from different companies may be present within any given dongle. Alternatively:

   o You can instead use the license from any computer into which iLok License Manager is currently logged into an **iLok Cloud session**. This is termed 'iLok Cloud licensing'. The '*iLok Cloud*' FAQ covers how to log into/out from iLok Cloud: https://www.ilok.com/#!faq. When a license is used in this way no hardware dongle is needed, but a reliable always-on Internet connection is required. You can freely switch between using different computers by closing Hauptwerk and closing the iLok Cloud session (via iLok License Manager) on one computer, then opening an iLok Cloud session (via iLok License Manager) and launching Hauptwerk on another, with the iLok Cloud system ensuring that only one instance of the license can be in use at any given time.

- You are able to move your license(s) freely around amongst iLok dongles and/or the iLok Cloud, and Hauptwerk licenses are neither computer-specific, nor platform-specific.

- For Hauptwerk, and Milan Digital Audio's sample sets, and for some third-party producers' sample sets, you may also transfer/sell your licenses to other users, without any approval or actions needed on our part. The iLok License Manager software has the necessary functionality and documentation for moving/transferring licenses, in conjunction with the iLok website (https://www.ilok.com/), and PACE should be contacted directly (via the iLok website) for any support needed with moving or transferring licenses. Their '*Your Licenses*' FAQ covers how to transfer licenses to a different user (a different iLok account name): https://www.ilok.com/#!faq, for which PACE will charge an administrative fee to you directly (as covered in their FAQ).

- There is a new edition of Hauptwerk, named the Hauptwerk Lite Edition, which is available on a subscription basis. It supersedes the previous Hauptwerk v4 Basic Edition, and has the same functional limitations that the v4 Basic Edition had (compared to the v4 Advanced Edition), except that:
  - It places no limit on the amount of memory an organ is allowed to use (instead of v4's 3 GB). (Polyphony remains limited to 1024, as for the v4 Basic Edition.)
  - The Hauptwerk AU/VST Link (and AU/VST support) is not available.
  - No technical support is available for the Custom Organ Design Module (although the module may still be used within it).

- The Basic and Free editions of Hauptwerk are no longer available.

- Yearly subscription licenses (which will work for all versions from 5 onwards) are available for the Hauptwerk Advanced Edition, and for the Hauptwerk Lite Edition, and perpetual Hauptwerk v5-specifc licenses are available for the Advanced Edition (only). Any type of license (Advanced or Lite, subscription of perpetual) may be used on either an iLok3/iLok2 dongle, or with iLok Cloud. If using a subscription license on an iLok dongle then the subscription needs to be renewed, and then refreshed on the dongle, before it expires at the end of each subscription period (year or month), for which the dongle will need to be connected (at least temporarily) to a computer that has an Internet connection and iLok License Manager installed. An Internet connection is only required when refreshing the license on the dongle, and the refresh operation may be performed by moving the dongle temporarily to an Internet-connected computer that has iLok License Manager installed. Subscription licenses for Hauptwerk itself, and for Milan Digital Audio's samples sets, are available via the Hauptwerk website.

- The Public Installation License has been discontinued, and any v5 license type (Advanced or Lite, perpetual or subscription) may now be used/installed in public installations, without additional licensing requirements.

- The new audio routing and impulse response convolution reverb functionality is available in the Advanced Edition only. In the Lite Edition, only a single stereo audio output is supported, as for v4.

- Technical support is now available from Milan Digital Audio via Hauptwerk Technical Support Incidents raised via our website support ticket only. If your Hauptwerk v5 license (or license upgrade) is purchased from Milan Digital Audio directly (not via a reseller), then some free support incidents are included, as follows. To receive support from Milan Digital Audio in other cases a Hauptwerk Technical Support Incident, or support plan, needs to be purchased from Milan Digital Audio. For further details please see the Hauptwerk license agreement on our website (or on the Help menu in this version of Hauptwerk), and Hauptwerk Technical Support Incident and support plan pricing on our website:
  - Hauptwerk Advanced Edition v5-specific perpetual licenses/upgrades: at most 4 free support incidents within the first 90 days from the date of license (or license upgrade) purchase.
  - Hauptwerk Advanced Edition subscription licenses/upgrades: at most 4 free support incidents within the first 90 days from the date of first purchase in the first year, and at most 2 free support incidents within the first 90 days of each subsequent renewed year.
  - Hauptwerk Lite Edition subscription licenses/upgrades: at most 1 free support incident within the first 90 days from the date of first purchase in the first year (and none in subsequent renewed years).

- If upgrading Hauptwerk from v2-4, then please note that the previous 'Hauptwerk USB key' HASP dongle that was used for v2-4 cannot be used for licensing this version of Hauptwerk, or for licensing sample sets.

- If upgrading Hauptwerk from v2-4, then please note that current version of Hauptwerk isn't compatible directly with copy-protected sample sets that were created for pre-v5 versions, so please contact the makers of any such sample sets to obtain upgraded v5+ compatible versions if needed. If you have purchased an upgrade to v5, once Hauptwerk v5+ has been installed, you will need to migrate any sample

set licenses that you may have from your pre-v5 'Hauptwerk USB Key' HASP dongle (which will remove them permanently from that dongle, rendering it no longer usable), activate the replacement v5+ licenses for those sample sets in iLok License Manager, then use *File | Install …* to install the updated v5+ compatible versions of the sample sets. Your settings, voicing, and combinations for those sample sets shouldn't be lost in the process. When purchasing an upgrade to version 5 you will be sent instructions for the sample set license migration process (which involves using a special menu function once, then submitting the resulting file via a website form). **Important**: once you have used the special menu function to migrate your pre-v5 Hauptwerk sample set licenses to v5+ there is no way to reinstate those pre-v5 sample set licenses, nor to reinstate your pre-v5 Hauptwerk license itself. Hence please make sure that you do indeed wish to upgrade <u>before</u> you use the menu function to migrate your pre-v5 sample set licenses.

- Before subsequently installing any new copy-protected iLok-licensed sample set (or impulse response reverb set), you should download the current 'Hauptwerk licensing packages' Hauptwerk component package file from Milan Digital Audio: https://www.hauptwerk.com/licensingpackages. Use '*File | Install …*' in Hauptwerk to install it. [The 'Hauptwerk licensing packages' link between Hauptwerk and Hauptwerk's iLok-based licensing system. They aren't licenses in themselves. The (master) 'Hauptwerk licensing packages' component package file contains the current versions of the licensing packages for *all* current copy-protected iLok-licensed sample sets (from all makers) and is hosted 'centrally' for download from Milan Digital Audio.]

- Hauptwerk v5 may be evaluated only once (for any given iLok account), and evaluation is limited to 14 days. During that period Hauptwerk will have the full functionality of the Advanced Edition (without any periodic triangle chime, audio muting, or any other functional limitation).

- 7-day trial activation codes are available for Milan Digital Audio's sample sets, and trial activation codes are available for some third-party producers' sample sets. Sample set trial activations may also be used when evaluating Hauptwerk itself.

- For further details about the new iLok-based licensing system, please see the following section in the main Hauptwerk user guide (on our website (or on the Help menu in this version of Hauptwerk):

  o *Licensing, editions, and technical support.*

  o *Hauptwerk prerequisites*.

  o *Installing/uninstalling/upgrading organs, temperaments, or reverbs (the component installer)*.

Advanced Edition only: other new rank voicing adjustment functionality

On the (renamed) '*Organ settings | Rank voicing and surround/3D/perspective panning*' screen you may now select multiple ranks/layers at once to adjust their settings simultaneously. The bank of sliders controls will then show the value of that adjustment parameter for each note in the (primary) selected rank whose name is shown above the bank of sliders. Note/*MSTR*/*QUICK*-slider adjustments are relative to their current parameter values unless the *ALT* key is held down, in which case value adjustments are absolute. A note slider will be highlighted in yellow if (and only if) you have more than one rank selected, and the adjustment parameter values for that note for ranks other than the displayed (primary) selected rank differ from that of the displayed (primary) selected rank. Thus if a note slider is highlighted in yellow then it indicates that the parameter value of the note is currently set differently for the various selected ranks, and that moving the slider will adjust those various values (relative to their current parameter values, if the *ALT* key is *not* held down, or setting them all to the displayed slider value, if the *ALT* key *is* held down).

The voicing screen also now has settings to allow the stereo balance of most modulations/filters to be adjusted. For example, you might make a modeled tremulant or swell box modulate the amplitude of a rank more strongly in the right-hand channel, whilst making it affect its harmonic content more strongly in the left-hand, thus giving a dynamic stereo effect. These new stereo-balance voicing adjustments also allow values beyond +/- 100 percent, with such values inverting the polarity of modulations. Most other modulation depth adjustments also now allow negative values, for polarity inversion.

The voicing screen also allows real-time, per-output-perspective (for surround/3D-sound), release tail truncation (in addition to the existing non-real-time release tail truncation available via the '*Organ | Load organ, adjusting rank audio memory options*' screen), which can help to make a wet sample set seems a little 'drier' than it would normally. (Please note that the real-time truncation functionality doesn't reduce the memory required for the organ, and you need to retrigger any held notes to hear changes.)

Performance and audio realism

- Performance (polyphony that can potentially be achieved, subject to the polyphony limit of the Hauptwerk edition) on a given computer should be a little better in general, and significantly so with stereo or surround sample sets. (Please note the standard polyphony testing organs are mono, but stereo organs should now achieve very nearly the same levels of performance as mono organs.)

- Additionally, performance on a given computer should be significantly better on CPUs that support the AVX, AVX-2, or AVX-512 instruction sets (such as most mid/higher-end CPUs made since about 2011).

- There should no longer be a significant difference in polyphony from loading ranks with memory compression enabled.

- Hauptwerk's background models (modeled tremulants, relay, and the Advanced Edition's wind supply model) should be smoother, improving overall quality and realism.

- Playing with multiple stops drawn should sound a little more realistic.

- PCs: organs should unload much faster on recent Windows 10 versions if Windows' page file is completely disabled (as a work-around to a performance bug relating to locked memory in recent Windows 10 updates, which Microsoft is aware of and aims to address properly in the longer-term).

- Hauptwerk should be a bit more resilient to audio glitches and CPU load spikes on Windows in general (although the PC still needs to be working well enough to handle real-time low-latency audio in general, as reported by utilities such as Resplendence Software's LatencyMon).

Platform support and prerequisites changes

- Macs: Hauptwerk fully supports, and is now only officially supported on, macOS 'Mojave' 10.14 and macOS 'High Sierra' 10.13.6 and later. (It might possibly still work on OS X 10.12 or 10.11, but we don't test or officially support them. It definitely won't work on 10.10 or earlier.)

- PCs: Hauptwerk fully supports current/recent 64-bit versions of Windows 10, and is now only officially supported on 64-bit Windows 10 and 64-bit Windows 7. (It might possibly still work on some other 64-bit pre-Windows 10 versions of Windows, but we don't test or officially support them. It definitely won't work on 32-bit versions of Windows, or on 32-bit PCs.)

- Basic support has been added for automatic screen scaling for 'high-DPI' screens, such as Mac 'Retina' and similar laptops. (Hauptwerk's screens should now scale automatically on high-DPI screens.)

- For traditional-DPI (non-'Retina') monitors: Hauptwerk requires a minimum display resolution of 1024 pixels horizontally by 900 pixels vertically for your (primary) monitor. For high-DPI monitors (such as Apple 'Retina' displays): Hauptwerk requires a minimum display resolution of 1536 pixels horizontally by 1350 pixels vertically for your (primary) monitor.

- A CPU that supports at least the SSE2 instruction set is still required (as for Hauptwerk v4), but in order to make best use of the new functionality in the Advanced Edition we strongly recommend a CPU with AVX, AVX2, or Intel AVX-512 (such as a recent Intel i9 or modern i7 processor made since about 2011).

- An audio interface and ASIO/Core Audio driver that supports power-of-two buffer sizes (128, 256, 512, 1024, 2048, or 4096) is recommended for lowest latency.

- The Hauptwerk AU/VST Link (Advanced Edition only) is supported with current versions of Cubase (10.x), Logic Pro X (10.x), Reaper (5.9x), and Garage Band (10.x).

- The amount of RAM a given sample set needs might be slightly different (in some cases higher, in others lower), compared to Hauptwerk version 4.

- To use or evaluate Hauptwerk, you need to have/create an account on https://www.ilok.com/, and to have installed the current version of iLok License Manager (which may be downloaded from there) on your Hauptwerk computer.

- If you wish to license Hauptwerk via a dongle (as opposed to via iLok Cloud) then you will need to have/buy an iLok3 (or iLok2) dongle, and have a spare USB port to which to attach it. Alternatively, if you wish to use iLok Cloud for licensing, then your Hauptwerk computer will need a reliable always-on Internet connection. Please see also the Licensing changes section above for further details.

Novation Launchpad 'mark 2' model support

Hauptwerk now has native support for the Novation Launchpad 'mark 2' model (whilst remaining compatible with the original 'mark 1'). Novation Launchpads are popular and cost-effective means for controlling Hauptwerk's virtual stops and pistons, allowing stop states to be seen by way of the assigned Launchpad buttons' internal lamps.

(As for Hauptwerk version 4), to use a Launchpad with Hauptwerk, please ensure that the Launchpad is connected to the computer before launching Hauptwerk, then ensure that it's enabled in the left-hand '*Console MIDI ...*' columns on both of the '*MIDI IN ports*' and the '*MIDI OUT ports*' tabs of the '*General settings | MIDI ports*' screen. Then, with your organ loaded, use standard right-click auto-detection to assign the Launchpad's buttons as desired to virtual stops/pistons/switches. You should see an option on the auto-detection screen allowing you to select the desired behavior for the Launchpad button's internal lamp.

Changes for the Custom Organ Design Module ('CODM')

- Hauptwerk now has native functionality (on the '*Design tools*' menu) to export/import CODM organ definitions to/from SQLite databases, for easier manipulation of their data via the power of the SQL language. Please see the CODM user's guide (also via the '*Design tools*' menu) for details.

- The CODM organ definition format documentation is now available in HTML format via a new '*View | Custom Organ Design Module ... format documentation*' menu function (instead of within the CODM's main user guide). Changes to the CODM organ definition format in each Hauptwerk version are now documented via this new menu function, and may be found by searching the resulting HTML document for '*HWvx.x.x*' (or appropriate sub-strings, where each 'x' represents a numerical version digit). Please search the document for '*HWv5.0.0*' to see the full list of changes for v5.0.0 (although, there are no major changes to the CODM organ definition format itself in this version).

- The CODM's user guide has been converted to portrait format, and is now available via the '*Design tools*' menu (instead of the Help menu).

- The maximum font size allowed within CODM organ definitions has been increased, to allow for 'high-DPI' ('Retina') displays.

- There is a new option on the '*Design tools | Load organ ...*' screen to reset user rank routing options.

- No technical support will be available for the Custom Organ Design Module for the Basic and Free editions (although the module may still be used in them).

- Bug-fix: percussive disengaging key action noises for divisions wouldn't work properly unless the *PercussiveEngagingKeyActionNoise_ChooseMIDINoteNumRandomly* CODM organ definition attribute was *Y* (since Hauptwerk v4.0.0).

- Bug-fix: the CODM example St. Anne's Moseley organ definitions had too much 'wind supply wobble' (since v3.0.0).

Changes for sample set developers

- Hauptwerk now has native functionality (on the '*Design tools*' menu) to export/import 'full-format' organ definitions to/from SQLite databases, for easier manipulation of their data via the power of the SQL language. *[**]*

- The organ 'full-format' definition format is now documented in HTML format via a new menu function on the '*Design tools*' menu. Changes to the organ definition format in each Hauptwerk version are now documented via this new menu function, and may be found by searching the resulting HTML document for '*HWvx.x.x*' (or appropriate sub-strings, where each 'x' represents a numerical version digit). Please search the document for '*HWv5.0.0*' to see the full list of changes for v5.0.0. *[**]*

- The organ definition format now allows pipe modulations with inverted polarity, and for modulation depths to be adjusted within the stereo field, in accord with the corresponding voicing adjustments. (Please see the format documentation for details.)

- Native component installer support has been added for multi-part archives in WinRAR v5's default (v5) archive format. To create multi-part RARs, please now select the default 'RAR' (not 'RAR4') archive format in WinRAR, specify the desired volume size, do <u>not</u> select the '*Old style volume names*' option, let WinRAR generate the files, then rename them to '*... .part1.CompPkg_Hauptwerk_rar*', ..., '*... .partN..CompPkg_Hauptwerk_rar*'.

- The maximum font size allowed within organ definitions has been increased, to allow for 'high-DPI' ('Retina') displays.

- The minimum output sample rate is now 44.1 kHz.

- It is no longer necessary for a dummy wind compartment linkage to exist if the organ doesn't use the wind supply model.

- There is a new option on the '*Design tools | Load organ ...*' screen to reset user rank routing options.

- The previous general preference to disable auto-compacting of organ settings has been renamed to clarify that it only does so for voicing data.

- There is a new '*Design tools | Generate a new ... UUID*' screen (which is currently relevant only for packaging impulse response reverbs).

- The maximum number of allowed console display tabs has been increased to 32.

- Bug-fix: *ThreePositionSwitchImage* organ definition objects weren't been working properly (since v2.0.0).

- Specifying an invalid value of 0 for *WindCompartmentLinkage.MassFlowRateKilogramsPerSecAtReferencePressureDiff* in an organ definition file would be accepted by Hauptwerk (causing it to be rounded it to the nearest valid value of 1e-32), but rejected by SQLite if exporting to a database. 1e-32 is now used as a default for the attribute for compatibility to allow such organ definition files to continue to load, and to export without error.

- ***Important***: since v5+ cannot load copy-protected sample sets for pre-v5 versions, it is imperative that all pre-v5 protected sample sets should be re-protected for v5+, and made available for download to their end-users (and/or publicly), as a matter of the highest possible priority. If you are a sample set developer who uses Hauptwerk's sample set copy-protection system, then please contact us privately for the necessary details (if we haven't contacted you already).

[**] Please see the current version of the Creating Sample Sets for Hauptwerk guide for details. The guide, and the relevant 'Design tools' menu functions, are made available to licensed Advanced Edition users upon request.

Other changes

- The bit-depth used by Hauptwerk's built-in audio recorder is now set via the '*General settings | General preferences*' screen, and defaults to 32-bit floating-point format (which default audio players on current operating systems should be able to play).

- The '*Sequencer MIDI IN/OUT*' ports have been renamed to '*Hauptwerk MIDI recorder/player external MIDI IN/OUT*' ports, to help to avoid confusion. The menu function that shows their documentation is now named '*Recording | View Hauptwerk MIDI recorder/player fixed, predefined MIDI implementation (for this organ)*'. Also, the MIDI sequencing and MIDI recorder/player MIDI implementation reference sections in the main Hauptwerk user guide have been reworked to make it clearer which sub-sections would be appropriate for most MIDI sequencer/DAW users.

- Changing the '*Reduce relay/MIDI/tremulant/model response/accuracy/quality for max polyphony*' organ preference no longer requires an organ to re-load.

- Changing any of the following no longer requires held notes to be re-triggered: voicing amplitude levels, voicing pans, and audio level trim.

- There is a new 'Clock' mini control panel (accessible via the View menu) that shows the computer's current time, particularly for the benefit of those who use Hauptwerk in full-screen mode. (Hauptwerk doesn't transmit that time via MIDI output, in order to avoid excessive MIDI traffic.)

- Macs: the Hauptwerk AU/VST Link (Advanced Edition only) Mac Audio Unit plug-in now provides 16 stereo outputs (rather than a single 32-channel output), for better multi-channel audio compatibility with Logic and Reaper. In order that Logic detects the changed configuration after upgrading: close any Logic projects, then use '*Logic Pro X | Preferences | Plug-in Manager*', highlight the Milan Digital Audio '*Hauptwerk AU Link*' plug-in, and click the '*Reset and Rescan Selection*' button. Logic should report '*AU validation succeeded*'.

- Installer: to help avoid issues with file/folder permissions, by default for new installation the Hauptwerk installer now installs its data files into a *Hauptwerk* folder within your computer account's home folder (instead of at the top level of your computer's main drive). As before, the 'Custom' option in the installer allows those default locations to be changed (but please do ensure that your computer account is allowed to write to any folders you may select). When upgrading, your existing installation locations will be used.

- Installer: for best compatibility with recent macOS versions, on Macs (only), the installer no longer requires you to enter your computer account's password, and will no longer run with administrator privileges (so please do ensure that your computer account is allowed to write to any folders you may select). Also, the Hauptwerk AU/VST Link plug-ins are now installed within your computer account's private plug-ins library (the */Library/Audio/Plug-ins* within your computer account's home folder, as opposed to the system-wide one, */Library/Audio/Plug-ins*). IMPORTANT: If upgrading from version 4 or earlier, please note that plug-ins from the earlier version won't be removed by this version's installer, so please make sure you use the current plug-in versions (if applicable).

- Installer: on macOS Apple's Java for OS X (Java 6 run-time) is no longer required. (Hauptwerk's installer instead now installs it own private installation of the Java 8 run-time, which is needed and used only by the installer and uninstaller.) Please note that on some Macs a spurious 'HauptwerkJavaRuntime' entry might appear in macOS' Launchpad application, which should be ignored.

- For Windows ASIO and Mac Core Audio drivers, and for the Hauptwerk AU/VST Plug-in Link, audio buffer sizes of 128 sample frames (about 2.7 ms of latency at 48 kHz), 2048 frames, and 4096 frames, are all now supported (whereas previously the smallest allowed was 256 frames, and the largest 1024.

- For the Hauptwerk AU/VST Plug-in Link, audio buffer sizes must also now be specified within Hauptwerk (since Hauptwerk requires its buffers' sizes to be powers of two and of a constant size, so that zero-latency impulse response reverb is possible within Hauptwerk). For good performance, the individual buffer size set in Hauptwerk should be no larger than the AU/VST host's buffer size and the total amount of Hauptwerk buffering (Hauptwerk individual buffer size multiplied by number of buffers) should be at least at much as the AU/VST host's buffer size. If you are certain that the host's buffer size will always be exactly the same as the buffer size set in Hauptwerk then you can set the number of buffers in Hauptwerk to 1, which should give the best possible performance and lowest latency. For the AU/VST Link the default Hauptwerk buffer values (size=256, number=4) should be reliable for any host buffer size in between 256 and 1024, giving a reasonable balance of performance.

- An organ may no longer be loaded in 14-bit resolution. (16-bit is now the minimum.)

- A new advanced general preference '*Try to run Hauptwerk at real-time priority on Windows*' has been added. On some PCs, running at real-time priority gives the most reliable audio/MIDI performance on Windows. However, automatically running at real-time priority usually requires that Hauptwerk be launched with Windows administrator privileges, in which case Hauptwerk's PDF documentation might not be accessible. (Running at real-time priority might possibly cause performance problems with other software running at the same time on the computer. The setting currently has no effect on other platforms.)

- A new advanced general preference '*Extra time to allow when starting audio on Windows if not running at real-time priority*' has been added. On Windows, if Hauptwerk isn't set to (or isn't allowed to) run at real-time priority, then some PCs are prone to audio an audio glitch/CPU-spike straight after starting audio. This setting usually guards against that, but makes starting audio slower. Specifically: when not running at real-time priority, Windows sometimes takes several seconds to move audio threads around amongst CPU cores, which might result in audio glitches. The setting makes Hauptwerk allow time for that to have happened before it starts streaming audio. We found about 3-7 seconds to work reliably on most PCs. Running Hauptwerk at real-time priority (either manually via Windows settings, or allowing Hauptwerk to do it automatically by running Hauptwerk with Windows administrator privileges, keeping the '*Try to run Hauptwerk at real-time priority on Windows*' preference ticked) should avoid the issue entirely, and usually gives more stable audio/MIDI overall anyway. (The setting currently has no effect on other platforms.)

- The method used to determine whether sample set data caches need to be regenerated no longer depends upon timestamps (to make it resilient to failing computer clock batteries).

- For users with multiple iLok dongles (or iLok Cloud accounts) each containing valid/active Hauptwerk sample set licenses: swapping dongles/accounts (when Hauptwerk isn't running) no longer causes sample set caches to be regenerated. (However, the dongle/account must still have a valid/active license for any sample set being loaded.)

- Macs: Hauptwerk attempts to prevent macOS putting it to sleep via App Nap (which could potentially cause performance issues and lack of responsiveness to MIDI and dropped USB/MIDI connections).

- Spurious progress indicators now shouldn't normally open behind other windows, which sometimes caused confusion with file browsers that remember their positions in recent operating system versions.

- When auto-detecting switches, any incoming MIDI sys-ex messages that originated from Hauptwerk are now ignored (for compatibility with MIDI hardware that requires a feedback loop).

- If upgrading from Hauptwerk versions 2 or 3 directly, MIDI settings will no longer be migrated. (We strongly recommended resetting all MIDI settings when upgrading to v4 anyway.) Likewise, v2/v3 audio engine preferences and organ preferences are no longer migrated.

- Documentation: tables of contents have been added to generated combination set text listings and MIDI recorder/player MIDI implementation documents.

- The polyphony testing organs now allow filters to be disabled, and allow rank memory options to be accessed/changed (via the usual '*Organ | Load organ, adjusting rank audio memory options*' screen), for performance testing. (Previously all ranks were fixed at 16-bit, uncompressed, single loops.)

- PCs: if necessary, Hauptwerk will wait and re-try briefly for an ASIO audio driver's sample rate to change asynchronously, before logging a warning, for compatibility with the current MOTU AVB ASIO driver.

- The MIDI piston/switch contact de-bouncing function time interval has been increased a little, for better compatibility with some types of MIDI pistons/switches.

- The MIDI console status output system has a new Boolean variable (parameter ID 86) *IsMIDIReady*, and *IsOrganReady* has been renamed to *IsOrganAndAudioAndMIDIReady*. *IsOrganAndAudioAndMIDIReady* and *IsReadyForUserInput* are now always sent first, and all of them now explicitly send 'off' messages when deactivating.

- The MIDI console status output system has a new CC variable (parameter ID 87) *MasterReverbWetnessScalerRawCCVal* (0=0%, 127=100%) for the corresponding control's value on the '*Audio Mixer, Routing and Voicing/Panning Settings*' large control panel.

- Disabling interpolation no longer saves additional CPU overheads, and neither does having no filters at all enabled (compared to having one filter enabled).

- PCs: support has been add for an ASIO driver audio stream format which we understand is needed by Marian audio interfaces' ASIO driver.

- The toggling MIDI program change stop switch MIDI event type (as used by Johannus/Makin/Wyvern) has been extended for compatibility with Musicom systems.

- Documentation: the LCD panel MIDI implementation section in the Hauptwerk user guide has been clarified regarding 7-bit character sets.

- Diagnostics: the computer's primary display's size, resolutions and DPI settings are now logged.

- PCs: Hauptwerk's installer no longer includes an option to configure Windows to start Hauptwerk automatically when the computer boots (since the preferred method in Windows 10 is for the user to control that directly from Task Manager).

- The 'MIDI hardware/console type' setting on the General Configuration Wizard now defaults from its corresponding general preference when the latter has previously been set.

- The 'master' and 'quick' sliders on the rank voicing screen now always 'zero' to their center positions (instead of to the default value for the selected adjustment).

- Selecting a menu item to open a real-time settings screen or voicing screen now always brings the screen to the foreground if it's already open.

- Various other minor cosmetic/usability improvements to settings screens, screen names, and menu function names.

Bug fixes

- Slightly too much 'free' RAM could be reported on some computers (mainly Macs), resulting in Hauptwerk allowing the RAM to be over-filled, potentially allowing the computer to become sluggish or freeze.

- Multiple loops with identical starting positions within a sample could cause a crash (since v2.0.0), notably with the original version of the OrganArt Media Steinkirchen sample set.

- If a floating control panel or piston toolbar had input focus then computer key presses mapped to functions didn't work (since v4.0.0).

- MIDI Master Fine-Tuning MIDI sys-ex messages weren't being interpreted correctly (since v4.1.0).

- LCD system: if very large numbers of LCD panels were used, some could fail to be cleared when stopping MIDI drivers (since v2.0.0, but more noticeable with v4.2.0+).

- Loading a pre-v4 combination set for the first time that also had last been loaded in an older/different organ definition (with the same OrganID) could cause a crash (since v4.0.0).

- Combination sets that hadn't been saved since upgrading to v.4.2+ could be slow to load.

- Under some circumstances the large floating control panels incorrectly allowed docking at the top/bottom of the main window.

- Selecting a View menu item by right-clicking on certain display items on the Audio, MIDI and Performance large control panel could incorrectly open the settings screen relating to the other items on that menu (since v4.0.0).

- Lengths of cross-fades to release samples could incorrectly depend slightly upon user-selected pitch/temperament/tuning when the sample set's cache was last generated (since v2.0.0).

- Various other minor fixes.

Known issues

- macOS: if you close the Touch Menu whilst it's in full-screen mode the whole computer screen may go black. As a work-around, please either avoid putting the Touch Menu's window into full-screen mode on macOS, or take it out of full-screen mode (which you can do by hovering at the very top-left edge of the screen so that macOS shows its title bar buttons temporarily, then clicking the green button again) before closing the Touch Menu's window.

- macOS: rarely, on some Macs, when selecting different tabs on the Touch Menu the Touch Menu has been seen to cease to redraw entirely (or for a period of time), and exiting and re-launching Hauptwerk has been necessary to make the Touch Menu respond properly again. This appears to be a macOS compatibility problem in the multi-platform library that we use within Hauptwerk.

- macOS: if you close Hauptwerk when in full-screen mode, then the windows might not get restored properly to full-screen when next launching Hauptwerk. As a work-around, if you want to use full-screen mode on macOS, then please always exit full-screen mode before closing Hauptwerk, then re-enter it when next launching Hauptwerk. (This is a confirmed high-priority compatibility issue with macOS 10.13+ in the multi-platform library that we use internally for Hauptwerk. We need to await a fix from the makers of that library.)

- macOS 10.15 and later: you need to launch Hauptwerk's installer by right-clicking on it and selecting 'Open' (since the installer isn't yet 'notarized' by Apple, which macOS 10.15+ require by default in order to be able to launch it by double-clicking on it).

- macOS: if the computer screen is in portrait format, or if the primary Hauptwerk window is smaller than a certain size and positioned near to the right-hand edge of the computer screen, then message boxes/prompts may sometimes be positioned partly off the right-hand edge of the window and screen, instead of centered over the main window. (This is either a compatibility issue between the version of the multi-platform library that we use internally for Hauptwerk and macOS 10.13+, or conceivably a bug in macOS itself.)

- macOS: if an organ is loaded which has many virtual console screen tabs (display pages), and if the Hauptwerk console window is less than a certain width, the tab names become abbreviated and the window may be pushed wider. (On Windows the tab names are instead always shown in full, but with arrow buttons to scroll through the excess tabs, which is ideal.)

- Recent macOS/Safari versions: on recent macOS versions, and if Safari is the default Web browser, when opening an HTML document from Hauptwerk two copies of the document may open. (This is a bug in either Safari or macOS themselves, and usually occurs even if opening an HTML document from the macOS command line, without Hauptwerk running. The problem does not occur on Windows, or on macOS 10.13.6, or if a browser other than Safari is set as the default. If you wish to avoid the issue you can use a different browser, such as Mozilla Firefox.)

- If you want your computer's operating system to launch Hauptwerk automatically when the computer boots, and if, on your computer, you find that doing so results in a 'license not found' error when the operating system launches Hauptwerk (due to the operating system launching Hauptwerk before the iLok system has finished starting), then you may instead need to launch Hauptwerk via a script/batch file that (for example) waits for a few seconds before it launches Hauptwerk.

- Hauptwerk v5+ should use a similar amount of memory for the data for any given organ itself, compared to v4, but v5+ does need to use some additional RAM for its surround/3D-cabapable audio engine and native reverb capabilities (with the exact figure depending on various factors, especially the polyphony limit setting and whether any reverbs are loaded), compared to v4. Typically, the v5+ Advanced Edition is likely to need around 200-250 MB more memory than v4 did. Hence if certain organs were almost filling your computer's memory in v4 then you will need to reduce their memory requirements via the '*Organ | Load organ, adjusting rank audio memory options*' screen (by disabling some ranks, or by setting them to load in lower audio resolutions, or with multiple loops or releases disabled, for example). As with any Hauptwerk version, it's extremely important not to over-fill your computer's, otherwise you may risk system instability. Also, an organ loaded in v8+ may need a little more RAM than in v5-v7 if the '*General settings | General preferences | Advanced …: Reserve RAM in chunks for fastest organ unloading*' option is ticked (as it is by default).

- When generating a sample set cache the time taken to load image files may be higher in v8+ than it was in previous versions, due to a performance issue within the multi-platform library that we use for Hauptwerk (which hopefully will be addressed by its makers in a future version). This is mainly only noticeable with sample sets which use very large numbers of images. Subsequent loads from cache are not affected (and actually are likely to load slightly faster than they did in v7).

- If you are upgrading directly from v5.0.0 and you had previously upgraded from a pre-v5 version to v5.0.0 (as opposed to upgrading from a pre-v5 version directly to v5.0.1 or later) and in v5.0.0 you retained/migrated your pre-v5 audio settings/routing, and you had installed and loaded any new organs in v5.0.0 (and/or in v5.0.0 you had subsequently used the General Configuration Wizard to reset your audio settings, but not also used the Organ Configuration Wizard to reset your rank audio routing for some organs), then (due to a bug that existed in v5.0.0) you might find that you hear no audio from those organs. In that case, with each of those organs loaded in turn, please simply use the '*Organ settings | Organ Configuration Wizard*' from the menu in Hauptwerk, keeping just the '*Reset rank routing …*' option ticked. (Alternatively, or additionally, if you wish you could use the '*Organ settings | Rank routing …*' screen to select your desired audio mixer bus group for output perspective 1 for each rank.)