

MIDI implementation

The MIDI input and MIDI output sections describe how MIDI input and output are configured generally.

This section is intended to provide additional reference for those building, buying or converting MIDI organ consoles for use with Hauptwerk. Please also consult the MIDI organ consoles section for suggestions and further information.

Hauptwerk's MIDI system is extremely flexible, designed to be compatible with almost all of the many diverse types of MIDI digital organs in existence, and any scheme by which an organ console may have been wired for MIDI. The MIDI implementation is also backwardly compatible with systems built for Hauptwerk version 1.

MIDI output is only available in the Advanced Edition of Hauptwerk, so the sections and references below that relate to MIDI output are not relevant for the smaller Hauptwerk Basic Edition.

Keyboards

Hauptwerk's virtual keyboards (manuals and pedalboards) respond to MIDI note-on/off messages with no restriction on MIDI port and MIDI channel for a keyboard as a whole. Theatre organ after-touch can be triggered by either:

A second set of key contacts, sending MIDI note-on/off messages on a separate MIDI port or channel (the ideal method).

Keys being played on a standard MIDI keyboard when their note-on velocity exceeds a specified threshold. Hauptwerk will release the virtual after-touch keys when the keyboard keys are released.

Keys being played on a standard MIDI keyboard when their polyphonic after-touch (pressure) exceeds a specified threshold. Hauptwerk will release the virtual after-touch keys when their pressure falls below the threshold.

Some sample sets are able to respond to key velocity. Hauptwerk provides a tracker action model which enables key velocity to be used to adjust the initial speech of pipes, where it is included in a sample set. However, velocity-sensitive keyboards are not a requirement.

Hauptwerk can produce MIDI output from virtual keyboards using standard note-on/off messages, again with no restriction on MIDI port or channel for a keyboard as a whole. Key on and off velocity is sent, but no after-touch.

Keyboard inputs and outputs are connected before key-action coupling.

Rank and division inputs and outputs

Hauptwerk's virtual ranks (but not divisions) can respond to MIDI note-on/off messages directly, with no restriction on MIDI port and MIDI channel for a rank as a whole. It can produce MIDI output from virtual ranks or divisions using standard note-on/off messages, again with no restriction on MIDI port or channel for a rank or division as a whole. Key on and off velocity is sent, but no after-touch.

Division outputs are post-coupling, i.e. may be affected by any virtual couplers engaged.

Rank inputs and outputs relate to single virtual ranks only, and are also post-coupling.

Rank input is entirely optional, and provides an alternative to input at the keyboard level. Unless Hauptwerk is to be used as a voice expander, the keyboard level would be the normal choice.

Switches

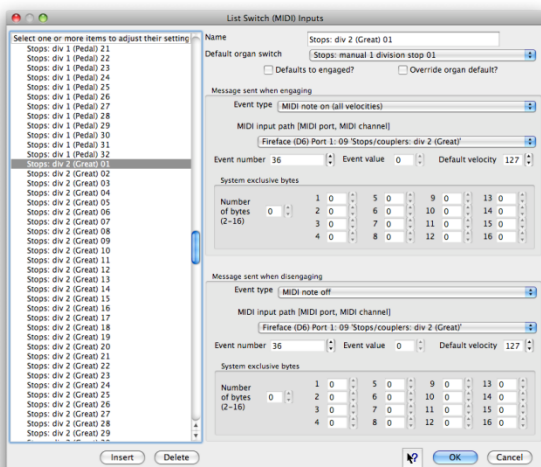
Hauptwerk's virtual switch inputs can be turned on or off by any of the following types of events, and the engaging and disengaging event types need have no relationship to each other. For example, if an engaging event was a MIDI note-on message, then it would be usual (and recommended) for the disengaging event to be a note-off message, but that is not

strictly a requirement; the disengaging event could instead be a program change if preferred. Any message type and MIDI input path can be used for either, with no restrictions.^(*) The event types are:

- MIDI note-on.
- MIDI note-on with a velocity exceeding a specified threshold.
- MIDI note-on with a velocity below a specified threshold.
- MIDI note-off.
- MIDI program change.
- MIDI control change, controller value ignored.
- MIDI control change with specific controller value.
- MIDI control change with controller value exceeding a specified threshold.
- MIDI control change with controller value below a specified threshold.
- MIDI note polyphonic after-touch exceeding a specified threshold.
- MIDI note polyphonic after-touch below a specified threshold.
- Computer keyboard key pressed.
- Computer keyboard key released.
- MIDI system exclusive (up to 16 bytes in total).
- MIDI RPN, controller value ignored.
- MIDI RPN with specific controller value.
- MIDI RPN with controller value exceeding a specified threshold.
- MIDI RPN with controller value below a specified threshold.
- MIDI NRPN, controller value ignored.
- MIDI NRPN with specific controller value.
- MIDI NRPN with controller value exceeding a specified threshold.
- MIDI NRPN with controller value below a specified threshold.
- None (engaging event toggles/pulses organ switch).

If your MIDI switch (or computer key) sends a message only as you press it down, and not when it is released, as is usual for push-buttons/pistons, then set the disengaging event type to 'none'. Hauptwerk will then automatically toggle the state of any connected virtual organ switch if it is a 'latching' switch such as a drawknob or tab, or briefly pulse its state on if the virtual organ switch is a 'momentary' piston.

For MIDI event types, any MIDI port and channel can be used for the engaging and disengaging events, hence there are almost no restrictions on message type, port or channel for any switch. Hardware switches are listed in Hauptwerk with the *General settings | Switch (MIDI) inputs* screen:



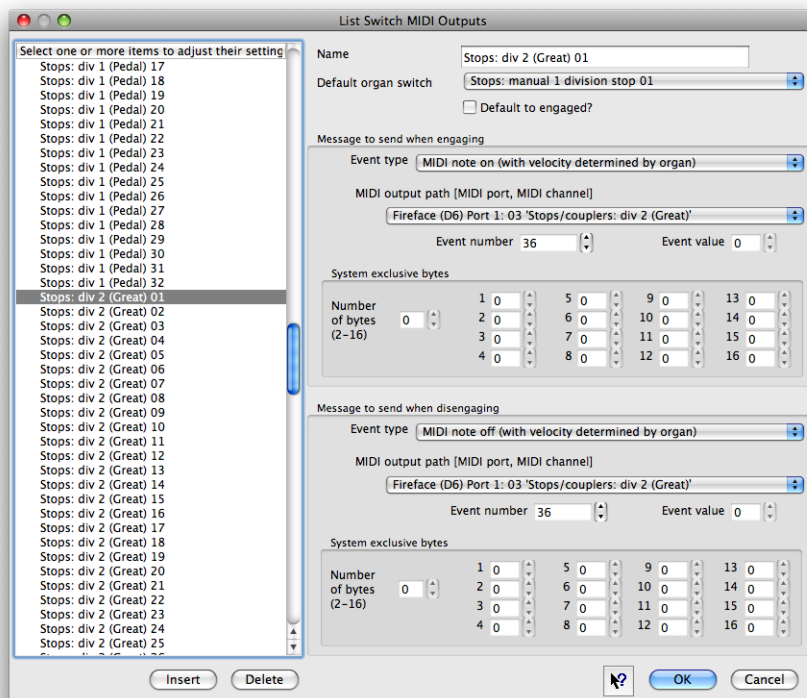
Any configured switch input can be used to control any of Hauptwerk's switches, including, for example:

- Virtual stops.
- Virtual couplers.
- Virtual tremulants.
- Virtual pistons.
- Any other virtual switches in a sample set.
- Hauptwerk's menu functions.

Hauptwerk's virtual switch outputs can produce any of the following types of events, and again the engaging and disengaging event types need have not necessarily have any relationship to each other (although it is recommended that they do).

- MIDI note-on with a fixed specified velocity.
- MIDI note-on with the velocity of the virtual switch.
- MIDI note-off with a fixed specified velocity.
- MIDI note-off with the velocity of the virtual switch.
- MIDI program change.
- MIDI control change.
- MIDI system exclusive (up to 16 bytes in total).
- MIDI RPN.
- MIDI NRPN.
- None (indicates that no message is sent to the hardware).

As for input events, any MIDI port and channel can be used for the engaging and disengaging events, hence there are almost no restrictions on message type, port or channel for any switch. Hardware switches are listed in Hauptwerk with the *General settings | Switch MIDI outputs* screen:



Hauptwerk can send such switch output events from any of its logical switches, such as:

- Virtual stops.
- Virtual couplers.
- Virtual tremulants.
- Virtual pistons.
- Any other virtual switches in a sample set.
- Hauptwerk system states (such as whether Hauptwerk is active).

Although you are free to use any of the event types described above, if you are wiring a new console, for simplicity and consistency our recommendations would be:

For MIDI switches which change state physically, such as solenoid-actuated/illuminated draw-knobs or tabs, use MIDI note-on/off messages for both input and output.

Similarly control indicator lamps from Hauptwerk with note-on/off messages.

For momentary push-buttons, such as non-latching pistons, send MIDI program change messages to Hauptwerk.

For the capture/setter piston, use a momentary push-button which sends a MIDI note-on message as it is pressed in, and a MIDI note-off message as it springs back out, so that it must physically be held in while in capture mode, thus preventing accidental erasure of combinations or menu stand-by assignments.

For ease of diagnosing problems and wiring we would also recommend using the same MIDI port and channel and, where applicable, note number, for both engaging and disengaging events for a given MIDI switch or indicator lamp.

Please see the appendix below for a list of computer key codes recognised for switch (MIDI) input computer key events.

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

Continuous controllers

Hauptwerk's virtual continuous controls are used to represent swell pedals, crescendo pedals and any other entities that may take one of a continuous range of values, such as the extension of a bellows.

Virtual continuous controls can be controlled by MIDI control change messages. Any MIDI port, channel and controller number can be used for any virtual control. Likewise a virtual control can send MIDI control change messages to indicate its position using any desired MIDI port, channel and controller number. The only restriction is that only MIDI control change messages can be used.

LCD panel system

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

Each panel can be controlled from any MIDI output port with no restrictions. Full details of the LCD panel system, including the format of the custom system exclusive messages, are given in the MIDI output section.

Custom MIDI output messages

Custom MIDI output messages can optionally be sent from Hauptwerk whenever it is activated and/or deactivated. These messages can each be sent to any MIDI port without restriction, and are specified as a sequence of up to 16 raw MIDI bytes so that any custom type of message that may be required by your hardware can be sent, including system exclusive messages.

Again, full details are given in the MIDI output section.

Miscellaneous MIDI port/channel restrictions

As covered above, there are no formal restrictions on MIDI ports or channels for any of the supported types of communication. However, please note that the *Transposer affects this path?* setting on the *General settings | MIDI input paths* screen is used to prevent the transposer affecting MIDI input paths which are used for switch MIDI inputs. Note that for this reason, you may prefer not to mix MIDI keys and MIDI control switches on a single MIDI encoder, where the setting would affect all note-on/off messages on the MIDI channel.

Menu functions

Except for functions which require user input, all of the functions on the *File, Organ, Combinations, Temperament* and *Functions* menus can be triggered by MIDI. Any input switch (as above) can trigger any one of the functions.

System state output

The following Hauptwerk system states can be used to control external indicator lamps or other indicator devices via any output switch (see above):

- MIDI system ready.
- Sample set loaded.
- Sample set loading.
- Error.
- Audio output recording in progress.
- Capture mode (combination setter) active.
- Re-directable input 1 route 1 active.
- Re-directable input 1 route 2 active.
- Re-directable input 1 route 3 active.
- Re-directable input 1 route 4 active.
- Re-directable input 2 route 1 active.
- Re-directable input 2 route 2 active.
- Re-directable input 2 route 3 active.
- Re-directable input 2 route 4 active.

Appendix: computer key codes

The following key codes can be used for 'Computer keyboard key pressed/released' event types for the *General settings / Switch (MIDI) inputs* screen:

Escape	16777216
Tab	16777217
Backtab	16777218
Backspace	16777219
Return	16777220
Enter	16777221
Insert	16777222
Delete	16777223
Pause	16777224
Print	16777225
SysReq	16777226
Clear	16777227
Home	16777232
End	16777233
Left	16777234
Up	16777235
Right	16777236
Down	16777237
PageUp	16777238
PageDown	16777239
Shift	16777248
Control	16777249
Meta	16777250
Alt	16777251
CapsLock	16777252

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NumLock	16777253
ScrollLock	16777254
F1	16777264
F2	16777265
F3	16777266
F4	16777267
F5	16777268
F6	16777269
F7	16777270
F8	16777271
F9	16777272
F10	16777273
F11	16777274
F12	16777275
F13	16777276
F14	16777277
F15	16777278
F16	16777279
F17	16777280
F18	16777281
F19	16777282
F20	16777283
F21	16777284
F22	16777285
F23	16777286
F24	16777287
F25	16777288

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F26	16777289
F27	16777290
F28	16777291
F29	16777292
F30	16777293
F31	16777294
F32	16777295
F33	16777296
F34	16777297
F35	16777298
Extra: Super_L	16777299
Extra: Super_R	16777300
Extra: Menu	16777301
Extra: Hyper_L	16777302
Extra: Hyper_R	16777303
Extra: Help	16777304
Extra: Direction_L	16777305
Extra: Direction_R	16777312
ANSI: Space	32
ANSI: Exclam	33
ANSI: QuoteDbl	34
ANSI: NumberSign	35
ANSI: Dollar	36
ANSI: Percent	37
ANSI: Ampersand	38
ANSI: Apostrophe	39
ANSI: ParenLeft	40

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ANSI: ParenRight	41
ANSI: Asterisk	42
ANSI: Plus	43
ANSI: Comma	44
ANSI: Minus	45
ANSI: Period	46
ANSI: Slash	47
ANSI: 0	48
ANSI: 1	49
ANSI: 2	50
ANSI: 3	51
ANSI: 4	52
ANSI: 5	53
ANSI: 6	54
ANSI: 7	55
ANSI: 8	56
ANSI: 9	57
ANSI: Colon	58
ANSI: Semicolon	59
ANSI: Less	60
ANSI: Equal	61
ANSI: Greater	62
ANSI: Question	63
ANSI: At	64
ANSI: A	65
ANSI: B	66
ANSI: C	67

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ANSI: D	68
ANSI: E	69
ANSI: F	70
ANSI: G	71
ANSI: H	72
ANSI: I	73
ANSI: J	74
ANSI: K	75
ANSI: L	76
ANSI: M	77
ANSI: N	78
ANSI: O	79
ANSI: P	80
ANSI: Q	81
ANSI: R	82
ANSI: S	83
ANSI: T	84
ANSI: U	85
ANSI: V	86
ANSI: W	87
ANSI: X	88
ANSI: Y	89
ANSI: Z	90
ANSI: BracketLeft	91
ANSI: Backslash	92
ANSI: BracketRight	93
ANSI: AsciiCircum	94

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ANSI: Underscore	95
ANSI: QuoteLeft	96
ANSI: BraceLeft	123
ANSI: Bar	124
ANSI: BraceRight	125
ANSI: AsciiTilde	126
Latin1: nobreakspace	160
Latin1: exclamdown	161
Latin1: cent	162
Latin1: sterling	163
Latin1: currency	164
Latin1: yen	165
Latin1: brokenbar	166
Latin1: section	167
Latin1: diaeresis	168
Latin1: copyright	169
Latin1: ordfeminine	170
Latin1: guillemotleft	171
Latin1: notsign	172
Latin1: hyphen	173
Latin1: registered	174
Latin1: macron	175
Latin1: degree	176
Latin1: plusminus	177
Latin1: twosuperior	178
Latin1: threesuperior	179
Latin1: acute	180

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Latin1: mu	181
Latin1: paragraph	182
Latin1: periodcentered	183
Latin1: cedilla	184
Latin1: onesuperior	185
Latin1: masculine	186
Latin1: guillemotright	187
Latin1: onequarter	188
Latin1: onehalf	189
Latin1: threequarters	190
Latin1: questiondown	191
Latin1: Agrave	192
Latin1: Aacute	193
Latin1: Acircumflex	194
Latin1: Atilde	195
Latin1: Adiaeresis	196
Latin1: Aring	197
Latin1: AE	198
Latin1: Ccedilla	199
Latin1: Egrave	200
Latin1: Eacute	201
Latin1: Ecircumflex	202
Latin1: Ediaeresis	203
Latin1: Igrave	204
Latin1: Iacute	205
Latin1: Icircumflex	206
Latin1: Idiaeresis	207

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Latin1: ETH	208
Latin1: Ntilde	209
Latin1: Ograve	210
Latin1: Oacute	211
Latin1: Ocircumflex	212
Latin1: Otilde	213
Latin1: Odiaeresis	214
Latin1: multiply	215
Latin1: Ooblique	216
Latin1: Ugrave	217
Latin1: Uacute	218
Latin1: Ucircumflex	219
Latin1: Udiaeresis	220
Latin1: Yacute	221
Latin1: THORN	222
Latin1: ssharp	223
Latin1: division	247
Latin1: ydiaeresis	255
Multi-key: AltGr	16781571
Multi-key: Multi_key	16781600
Multi-key: Codeinput	16781623
Multi-key: SingleCandidate	16781628
Multi-key: MultipleCandidate	16781629
Multi-key: PreviousCandidate	16781630
Chararcter set mode switch	16781694
Japanese: Kanji	16781601
Japanese: Muhenkan	16781602

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Japanese: Henkan	16781603
Japanese: Romaji	16781604
Japanese: Hiragana	16781605
Japanese: Katakana	16781606
Japanese: Hiragana_Katakana	16781607
Japanese: Zenkaku	16781608
Japanese: Hankaku	16781609
Japanese: Zenkaku_Hankaku	16781610
Japanese: Touroku	16781611
Japanese: Massyo	16781612
Japanese: Kana_Lock	16781613
Japanese: Kana_Shift	16781614
Japanese: Eisu_Shift	16781615
Japanese: Eisu_toggle	16781616
Korean: Hangul	16781617
Korean: Hangul_Start	16781618
Korean: Hangul_End	16781619
Korean: Hangul_Hanja	16781620
Korean: Hangul_Jamo	16781621
Korean: Hangul_Romaja	16781622
Korean: Hangul_Jeonja	16781624
Korean: Hangul_Banja	16781625
Korean: Hangul_PreHanja	16781626
Korean: Hangul_PostHanja	16781627
Korean: Hangul_Special	16781631
Multimedia: Back	16777313
Multimedia: Forward	16777314

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Multimedia: Stop	16777315
Multimedia: Refresh	16777316
Multimedia: VolumeDown	16777328
Multimedia: VolumeMute	16777329
Multimedia: VolumeUp	16777330
Multimedia: BassBoost	16777331
Multimedia: BassUp	16777332
Multimedia: BassDown	16777333
Multimedia: TrebleUp	16777334
Multimedia: TrebleDown	16777335
Multimedia: MediaPlay	16777344
Multimedia: MediaStop	16777345
Multimedia: MediaPrevious	16777346
Multimedia: MediaNext	16777347
Multimedia: MediaRecord	16777348
Multimedia: HomePage	16777360
Multimedia: Favorites	16777361
Multimedia: Search	16777362
Multimedia: Standby	16777363
Multimedia: OpenUrl	16777364
Multimedia: LaunchMail	16777376
Multimedia: LaunchMedia	16777377
Multimedia: Launch0	16777378
Multimedia: Launch1	16777379
Multimedia: Launch2	16777380
Multimedia: Launch3	16777381
Multimedia: Launch4	16777382

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Multimedia: Launch5	16777383
Multimedia: Launch6	16777384
Multimedia: Launch7	16777385
Multimedia: Launch8	16777386
Multimedia: Launch9	16777387
Multimedia: LaunchA	16777388
Multimedia: LaunchB	16777389
Multimedia: LaunchC	16777390
Multimedia: LaunchD	16777391
Multimedia: LaunchE	16777392
Multimedia: LaunchF	16777393
Multimedia: MediaLast	16842751
Keypad navigation: Select	16842752
Keypad navigation: Yes	16842753
Keypad navigation: No	16842754
Newer misc: Cancel	16908289
Newer misc: Printer	16908290
Newer misc: Execute	16908291
Newer misc: Sleep	16908292
Newer misc: Play	16908293
Newer misc: Zoom	16908294
Device keys: Context1	17825792
Device keys: Context2	17825793
Device keys: Context3	17825794
Device keys: Context4	17825795
Device keys: Call	17825796
Device keys: Hangup	17825797

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Device keys: Flip	17825798
Dead: Grave	16781904
Dead: Acute	16781905
Dead: Circumflex	16781906
Dead: Tilde	16781907
Dead: Macron	16781908
Dead: Breve	16781909
Dead: Abovedot	16781910
Dead: Diaeresis	16781911
Dead: Abovering	16781912
Dead: Doubleacute	16781913
Dead: Caron	16781914
Dead: Cedilla	16781915
Dead: Ogonek	16781916
Dead: Iota	16781917
Dead: Voiced_Sound	16781918
Dead: Semivoiced_Sound	16781919
Dead: Belowdot	16781920
Dead: Hook	16781921
Dead: Horn	16781922
[Unknown key]	33554431