HX3 MIDI expander module

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HX3 MIDI expander is a tonewheel organ emulation with all B3 features in a small box. Controlled completely via MIDI, selectable CC-sets for NI B4, Hammond XK, Hamichord and other. 30 presets (to be stored locally), many parameters tweakable by simple menus - like key contact flex and damping for key click response, more or less percussion punch etc. And, of course, it yields the legendary unmatched HX3 sound.

Features

- Compact organ emulator module in aluminum box, 222 x 150 x 42 mm
- Authentic reproduction of generator, tapering, key contacts, percussion and vibrato by FPGA (Field Programmable Gate Array)
- Extremely low internal latency of 50 microseconds Key-to-Audio (see note below)
- Natural key click by "rattling" contacts
- Accurate Rotary simulation with separate 122 amp output
- MIDI IN accepts 5 different MIDI CC sets
- 7 LEDs show vibrato and percussion setting
- LCD display and menu system with 2x16 presets, virtual drawbars and parameter tuning
- Swell (expression) pedal and footswitch jacks
- Built-in reverb DSP with 3 levels
- DC input 9 to 12V, 500 mA min.

Note: HX3 yields an extremely low latency of 50 microseconds Key-to-Audio (not >20 ms as with other MIDI expanders and software emulation). However, MIDI transmission delays still occur which are about 1 ms per note played.

Jack Connections

The HX3 expander module has two 1/4" stereo **audio output jacks**, one DC input jack and two accessory jacks on back panel.

- **MAIN/BASS:** Separate output for main organ manuals (plug tip) and pedal (plug ring). Use Y-cable or stereo cable to obtain both channels. Output level is approx. 150 mV at full swell. May be configured by menu to custom setting.
- **LESL/AMP:** Rotary speaker simulation in stereo. May be configured by menu to custom setting.
- **SWELL:** Expression pedal input is compatible with Yamaha FC-7 and similar expression pedals (direct connection preferred for speed/accuracy, but may also be remoted by MIDI control change, controller 11).
- **FOOTSW:** Single or double footswitch controls simulated **Rotary speed**: SLOW/FAST on plug tip, RUN/STOP on plug ring. Please use latching foot switches; momentary (button type) switches are not supported. If single footswitch used, Rotary is always on RUN (no plug ring, input grounded by plug sleeve).
- **DC IN:** Use stabilized DC wall wart 9 to 12V with at least 500mA current output, inner/outer plug diameter 2.1/5.5 mm on DC input jack. Polarity: positive supply on inner tip.

Audio output jacks are configurable by menu. See **HX3 MenuPanel** section for description.

Volume Control

Organ's **volume** is controlled by an expression pedal or MIDI CC “Expression”. HX3 resembles a loudness curve exact of Hammond B3's swell pedal, so volume will not reach zero.

We recommend connecting an expression pedal **Yamaha FC-7** or similar (1/4" jack, 10k to 47k total resistance) directly to the module, as it has a higher resolution and acts faster than MIDI control by MIDI CC.

MIDI Control

HX3 expander accepts MIDI key on/off events (default: channel 1 to upper manual, 2 to lower manual, channel 3 to bass pedals) as well as various MIDI CCs with selectable compatibility sets. There is a slight influence to key click noise be MIDI dynamics. Please see chapter **Using HX3 with MIDI controllers** for details. SysEx data is always ignored. MIDI OUT acts as a MIDI TRHU output on HX3 expander, as no internal key events are transmitted.

HX3 expander may be remoted via given MIDI CC set, but some settings are available via menu system only. If a valid MIDI CC command is received (despite expression/volume changes) for current MIDI CC set, MenuPanel will briefly show the changed parameter.

General

Please connect MIDI out of your MIDI controller to HX3 MIDI input. Some controllers have MIDI merge inputs. Your keyboard connects here. If your keyboard supports MIDI merge, the MIDI controller should be first, routed to the keyboard and from keyboard to HX3. This may avoid a few milliseconds of latency. Please note: HX3 does not introduce any audio latency.

As MIDI being a one-way interface, HX3 cannot determine the setting of any MIDI controller value until you touch/use it once. As default, all HX3 controllers are OFF. Do not use any controller button or drawbar unless HX3 is ready to accept its data; it is a good idea to power up HX3 first and later your MIDI master keyboard or master controller.

A valid MIDI CC received will override HX3's own analog controllers and switches until they are touched again. If you use your HX3-attached swell pedal, any MIDI expression message will be overwritten. Otherwise, by not touching the attached swell pedal, MIDI expression messages are accepted.

Note: Some MIDI controllers as well as organ keyboards (like Hammond KX and SK series) allow 2nd and 3rd harmonic percussion ON at same time. HX3 implementation regards "2nd ON" as "percussion ON" tab in this case.

Volume Control

Organ's **volume** is controlled by an expression pedal or MIDI CC #11 (may also be another CC number on various MIDI CC sets to retain compatibility). HX3 resembles a "loudness" curve exact of Hammond B3's swell pedal, so volume will not reach zero.

We recommend connecting an expression pedal **Yamaha FC-7** or similar (1/4" jack, 10k to 47k total resistance) directly to the module, as it has a higher resolution and acts faster than MIDI control by MIDI CC #11. Anyway, instead of the ORGAN MAIN output you may use the simulated Rotary Amp 122 output instead which has a separate volume pot (for example by MIDI CC $4C hex, 76 decimal in NI B4 MIDI CC

set). It may be also be changed by MenuPanel entry "RotaryVolume" (to be reached directly by pressing DATA ENTRY knob after power-on).

MIDI CC #7 controls the Rotary amp volume which only affects the Rotary/AMP Rotary Sim and Rotary Amp output jack.

Example 1: Voce MIDI Drawbars

Using your HX3 board with Voce MIDI Drawbars is straightforward, as the Voce module supports only one MIDI channel (i.e. upper manual) at any time. Please note that Voce MIDI Drawbars does not send drawbar data unless you press the “Drawbar/Save” button, so it’s LED lits up.

You may change the Voce MIDI Drawbars send channel (back rotary HEX switch) at any time to lower (2) and bass channel (3), although this is somewhat inconvenient. Have your technician install a toggle switch on the back side so channels may be changed easily.

Example 2: Doepfer d3c or other NI B4 drawbar controller

The Doepfer d3c drawbar controller is a very nice and rugged piece of gear, so we recommend it for use with our HX3 board. It has support for foot controllers and foot switches.

Upper, lower and bass drawbars work as usual. It is a good idea to set all to zero before switching on as this is a “known state” for HX3. Also the Percussion and Vibrato buttons work as described in d3c manual. There is a small drawback, anyway: Default HX3 Vibrato setting is V1 (but upper/lower vibrato OFF), while the V1 LED will not light when powering up the d3c (there is no “V0” on a real Hammond!). So pressing the V1 button will not change the sound – just it’s LED turns on.

The "Body” and “Brightness” knobs control AO28 equalization in HX3, not in a Rotary. There is no key click emulation in HX3 (it is just there!), so you may not adjust key click (a real Hammond does not have key click adjustment, either). The “Key Click” knob controls the bass sustain instead. You may argue “a real Hammond does not have a bass pedal sustain, too”. Right, but many aftermarket kits are installed, so this is OK (for me). Do not use the “Harmonic content” knob as it sends the “Percussion” button’s controller number like a continuous controller. Why that? No idea. This is definitely of no use.

Preset buttons may be used, but in a restricted way. First, HX3 yields 15 presets per manual, not 127 like NI B4. When selecting “Bank 1”, all 12 available preset buttons work on upper manual. When selecting “Bank 2”, all 12 preset buttons work on lower manual. Doepfer d3c resends the program change message when changing the bank, which may be annoying. Choose bank 2, lower preset first, then bank 1, upper preset. BTW: Bank buttons do not send bank select messages, they just add an offset to the preset buttons. Blame Doepfer for that.

Doepfer d3c preset 1 is the HX3 “Live” position. It will be saved automatically when switching to a preset sound (2 to 12). If you return to preset 1 “Live”, your last

drawbar/button setting will be recalled. Please note: HX3 tracks drawbar and button changes even when in preset position 2 to 12, so it keeps itself updated all the time.

There is no way to save a upper or lower preset/program remotely. You have to use the local HX3 “Save Upper” or “Save Lower” buttons instead (or use the MenuPanel Save function). To create a sound, choose the preset button you want. Set upper or lower drawbars and buttons to your taste. Press HX3 “Save” button for at least 2 seconds. The “Memory” LED will blink a few times, showing that your preset has been saved. It is not possible to save a sound to preset 1 as this is the “Live” preset.

Example 3: Hammond XK/SK series

HX3 supports most of Hammond XK MIDI controller functions. For convenience, some controllers have been relocated to other HX3 functions:

- XK Overdrive knob controls HX3 Rotary tube **Amp Volume**
- XK Reverb button controls HX3 lower manual **Vibrato On**
- XK Tube On button controls HX3 Reverb

Menu Panel

The Menu Panel knob “Data Entry” will change drawbar preset numbers from 0 to 15, parameters in other menu entries or Rotary Volume, depending on menu mode.

On power on, the presets/drawbar menu is present. Press knob briefly to switch to Rotary Volume control and back.

Each manual yields 16 presets (0..15). An arrow indicates if upper or lower manual preset change is active. Use Up/Down buttons to switch from upper to lower and vice versa. LEDs will show current percussion and vibrato state as well as Rotary speed (LED blinks according to rotary frequency).

Press Up/Down buttons several times to reach other menu entries. For faster access, upper drawbar settings are located on top of preset menu, lower drawbar settings are located below of preset menu.

Changing Parameters

- Use Up/Down buttons to scroll through menu items. Press and hold buttons for fast **auto-repeat** to next parameter group.
- Use the incremental encoder knob “Data Entry” to change parameter values. Changes are temporary; to make them permanent, press incremental encoder knob for 2 seconds until a “Saved” message appears in display. Changed parameters which have not yet been saved are marked with an "*" asterisk in upper display line.
- In main menu (presets/drawbar display), turning the knob changes preset numbers for upper or lower manual.

The menu system consists of about 70 entries. A "<" arrow will direct to the parameter to be changed. Vertical arrows indicate if parameter is at limits or not.

Main Display Upper/Lower

- **DrbUXXXXXXXXX** - default main menu, shows upper drawbar settings as numbers 0 to 8 (here represented as "X"). Incremental knob recalls UPR (upper preset) number. Preset 0 is a “live” setting UDB (upper drawbars). Returning from any preset UPR to drawbars UDB restores last drawbar setting.
- **PXXLXXXXXXXXX**- same for pedal (P) and lower (L) drawbars, incremental knob recalls preset.

Menus Upper

Step upwards to reach upper manual settings; change to desired value by turning incremental encoder knob. Save changes to current preset by pressing knob for more than 2 seconds. On “live” drawbar preset 0 (DrbU) any changes are always saved temporarily and restored when returning from preset to “live” in main menu.

- **UpperDB 1 to UpperDB 16** - drawbar setting for upper manual
- **UPR<LWR Vibr** - vibrato/chorus ON/OFF for upper manual
- **UPR LWR Vibr<** - vibrato knob setting V1 to C3
- **Percussion** - will step through available percussion combinations of NORM/SOFT, FAST/SLOW, 2nd/3rd (8 options) plus OFF.

Menus Lower

Step downwards to reach lower manual settings; change to desired value by turning incremental encoder knob. Save changes to current preset by pressing knob for more than 2 seconds. On “live” drawbar preset 0 (DrbL) any changes are always saved temporarily and restored when returning from preset to “live” in main menu.

- **UPR LWR<Vibr** - vibrato/chorus ON/OFF for lower manual
- **LowerDB 16 to LowerDB 1** - drawbar setting for upper manual
- **PedalDB 16 to PedalDB 8** - drawbar setting for pedals
- **PedalSustain** - changes pedal sustain release time. Set to 0 to obtain B3 pedal sound. Saved to lower preset
- **BassOnRotary** - routes pedal signal to Rotary simulation if ON.
- **Audio Jacks** - Switches between two output configurations A or B which may be configured separately in Defaults section (see below).
- **KeyboardSplit** - set split ON or OFF, default pedal to lower, 2 octaves. If one key pressed while switching to ON on lower manual, this key will be the "pedal to lower" split point. If one key pressed while switching to ON on upper manual, this key will be the "lower to upper" split point, lower manual switched off. If **two** adjacent keys pressed while switching to ON on upper manual, this key will be the "pedal to upper" split point. Note: split point setting is only valid until power-off.

Menus Defaults

These parameters are saved to power-on defaults when encoder knob is pressed more than 2 seconds. Factory defaults are shown in brackets like <*123*>.

Commons Group

- **RotaryVolume** <*70*> - adjusts Rotary Amp simulation volume from 0 to full (overdriven tube amp).
- **ReverbLevel** <*0*> - adjusts reverb level OFF, 1, 2 or 3. Sets one of three different reverb programs, each adjustale (see below).
- **MIDI Channel** <*1*> - sets MIDI base receive channel 1 to 10 (upper manual, lower manual is on +1, pedals on +2).
- **MIDI Option** <*RcvSendMerge*> - sets MIDI routing behaviour to
    - 'ReceiveThru' (MIDI OUT is THRU),
    - 'ReceiveSend' (MIDI received, only own MIDI key events to MIDI OUT),
    - 'RcvSendMerge'(MIDI received, own MIDI key events and incoming MIDI events merged to MIDI OUT) and
    - 'RcvSndMgNoCC' (as before, but MIDI CC commands discarded). On expander module, only valid setting is 'ReceiveThru'.
- **MIDI CC Set** <*NI B4*> - sets recognized MIDI CC set to
    - 'NI B4' Native Instruments B4 (default),
    - 'Voce' MIDI drawbars,
    - 'Hamichord' (or 'KeyB Duo' on special request),
    - 'Hammond XK',
    - 'Hammond SK' (Note: Hammond changed MIDI CC set between XK and SK series, so try out which will fit), or
    - 'KeyB Duo'.
- **SplitOption** <*PedalToLower*> - split setting on power-up, engaged when split set to ON (see above)
    - 'PedalToLower',
    - 'LowerToUpper' or
    - 'PedalToUpper'
- **Transpose** <*0*> - transposes from -6 to +7 semitones. Notes beyond 5 octave limits of B3 will not produce any sound due to accuracy of physical model.

Output Configuration

HX3 generates five output signals: **Rot**ary stereo simulation **L**eft/**R**ight, **Organ**, **B**ass **Pedal,** and organ on tube **Amp** simulation. All output signals may be routed to any output jack. Two configurations are available, so you may set these for your own needs and toggle between them simply by "Audio Jacks" menu (see above). There are 32 entries total on each configuration: 16 with **no bass pedal** added, and same 16 **with bass pedal** added to organ, amp and Rotary sim signals (marked by **+B** in display). Please note: It is not possible to route the same signal to more than one output.

- **AudioJ Conf A** sets audio jack configuration A and
- **AudioJ Conf B** sets audio jack configuration B.

The **HX3 mk2** has two stereo output jacks, so 4 signals are available simultaneously:

Jack1 tip/ring - Jack2 tip/ring

- ORG/PD - L/R
- PD/ORG - R/L
- L/R - ORG/PD
- R/L - PD/ORG
- ORG/L - PD/R
- L/ORG - R/PD
- PD/R - ORG/L
- R/PD - L/ORG
- AMP/PD - L/R
- PD/AMP - R/L
- L/R - AMP/PD
- R/L - PD/AMP
- AMP/L - PD/R
- L/AMP - R/PD
- PD/R - AMP/L
- R/PD - L/AMP

Description: **L** and **R** = rotary cabinet sim left/right channel, **ORG** = plain organ signal like G-G on B3, **AMP** = organ signal with Rotary tube amp sim and overdrive (controlled by Rotary volume pot or parameter), **PD** = bass pedals.

Vibrato Group

- **Vib1 Age** <*28*> - adjusts amplitude modulation and reflections caused by delay line on V1/C1 knob setting.
- **Vib1 FreqMod** <*70*> - adjusts frequency modulation on V1/C1 knob setting.
- **Vib2 Age** <*55*> - adjusts amplitude modulation caused by delay line on V2/C2 knob setting.
- **Vib2 FreqMod** <*110*> - adjusts frequency modulation on V2/C2 knob setting.
- **Vib3 Age** <*80*> - adjusts amplitude modulation and reflections caused by delay line on V3/C3 knob setting.
- **Vib3 FreqMod** <*170*> - adjusts frequency modulation on V3/C3 knob setting.
- **ChorDryMix** <*160*> - adjusts vibrato chorus mix dry (unmodulated) part in C1/C2/C3 setting.
- **ChorVibMix** <*150*> - adjusts vibrato chorus mix wet (FM/AM modulated) part in C1/C2/C3 setting.
- **PercNormLvl** <*160*> - adjusts percussion level in PERC ON, NORMAL tab setting.
- **PercSoftLvl** <*85*> - adjusts percussion level in PERC ON, SOFT tab setting.
- **PercLongTm** <*14*> - adjusts percussion decay rate in PERC ON, SLOW tab setting (higher value = faster).
- **PercShortTm** <*30*> - adjusts percussion decay rate in PERC ON, FAST tab setting (higher value = faster).

Generator Group

- **TG Flutter** <*7*> - adjusts tone generator "sloppyness" (spring clutch tension, bearing precision).
- **TG Leakage** <*Old Organ*> - sets tone generator leakage to
    - 'OFF' (never seen that)
    - 'New Organ' (recapped/new generator),
    - 'Old Organ' (higher leakage on several notes) or
    - 'Sleazy Organ' (lots of beer inside).
- **TG OldCaps** <*OFF*> - sets tone generator red caps (OFF) or wax caps (ON). With wax caps, TG notes also get more k2 distortion.
- **No DB1 @Perc** <*ON*> - enables drawbar 1 cancel when percussion ON (as original B3)
- **DB16 1st Oct** controls Foldback on 16' lowest octave. Foldback is configurable in 4 settings:
    - foldback with full level,
    - foldback with muted level (original B3 behaviour),
    - no foldback ("all way down") with full level (like H-100) or
    - no foldback ("all way down") withmuted level.
- **TrebleEqu** <*30*> - mimics TONE pot on AO28 amp; well, a little bit more on high values.
- **BassEqu** <*90*> - bass equalizer, adjusts bass response of different AO28 models.
- **AO28 tube k2** <12> - controls simulated AO28 preamp tube aging (higher triode distortion k2).
- **ContSpringFlx** <*6*> - adjusts key contact spring flex, affects click length
- **ContSpringDmp** <*9*> - adjusts key contact spring damping, affects click frequency

Reverb Group

- **Reverb 1 Lvl** <*100*> - controls reverb amount and length on Reverb program 1 setting.
- **Reverb 2 Lvl** <*160*> - controls reverb amount and length on Reverb program 2 setting.
- **Reverb 3 Lvl** <*170*> - controls reverb amount and length on Reverb program 3 setting.

Rotary Group

- **HornSlowTm** <*16*> - Rotary simulation horn revolution timer when set to SLOW
- **RotorSlowTm** <*14*> - Rotary simulation rotor revolution timer when set to SLOW
- **HornFastTm** <*130*> - Rotary simulation horn revolution timer when set to FAST
- **RotorFastTm** <*120*> - Rotary simulation rotor revolution timer when set to FAST

- **HornRampUp** <*4*> - Rotary simulation horn accelleration from SLOW to FAST.
- **RotorRampUp** <*20*> - Rotary simulation rotor accelleration from SLOW to FAST.
- **HornRampDown** <*3*> - Rotary simulation horn brake time from FAST to SLOW.
- **RotorRampDown** <*30*> - Rotary simulation rotor brake time from FAST to SLOW.
- **Rotary Throb** <*200*> - Rotary simulation "throb" modulation factor.
- **Rotary Spread** <*200*> - Rotary simulation stereo spread (width). **Rotary BaInce** <*200*> - Rotary simulation volume balance horn/rotor.

Various Group

- **ScanBoard** <*any*> - sets scan core for attached scan board (MIDI only on expander)
- **ExpanderMode** <*OFF*> - disables all analog control pot/drawbar inputs despite swell pedal (ON default on expander)
- **SwellInEna** <*ON*> - enables swell pedal input jack, default ON
- **FixedSwell** <*200*> - fixed swell volume, only applies if swell pedal input jack (SwellInEna) is OFF
- **TonePotEna** <*OFF*> - enables analog control input for TONE pot (OFF on expander)
- **LesVolPotEna** <*ON*> - enables analog control input for 122 Amp simulation volume pot (OFF on expander)