HX3 Drawbar Expander

HX3 Drawbar Expander is a tonewheel organ emulation in a compact box – an organ just without the keys. 32 drawbar presets, 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 with two sets of drawbars plus pedal
- Authentic reproduction of generator, tapering, key contacts, percussion and vibrato by FPGA (Field Programmable Gate Array) and physical modeling
- Extremely low internal latency of 50 microseconds Key-to-Audio. However, MIDI transmission delays are about 1 ms per note played.
- Natural key click by "rattling" contacts
- Accurate Rotary simulation with separate 122 amp output
- Dual MIDI IN for 2 separate keyboards or bass pedal
- MIDI OUT sends NI B4® compatible control codes
- LED buttons show vibrato and percussion setting
- LCD display and menu system with 2x16 presets and parameter tuning
- Swell (expression) pedal and footswitch jacks
- Separate outputs for amp and rotary simulation as well as plain organ
- Connector for 11-pin Leslie® Speakers
- USB for firmware updates and parameter editor
- Built-in reverb DSP with 3 levels
- hand-crafted in Germany

Default MIDI setting is channels 1/2/3 for upper/lower/bass, MIDI CC NI B4 with Sustain on CC #64.

DC input 9 to 12V, 500 mA min., 5.5/2.1 mm plug, plus on center.

Please read this manual carefully before using the HX3 Drawbar Expander.

Only clean with damp soft cloth. Using detergents or solvents may deteriorate finish and lettering.

Wood parts are unique, so deviations in colour and texture may occur. Maintain finish by using medium dark wood wax or wood oil. Do not allow water spills to stain into wood.

Keep packaging in case of service shipment.

Only use appropriate power supply as advised. Input voltages exceeding 15V may damage the device.

Designed for indoor use only. Do not use HX3 Drawbar Expander in moist places. Do not spill liquids or solvents into unit.

No user-serviceable parts inside. Refer to qualified technician or service representative if problems occur.

EU conformity declaration

This device conforms to EU regulations CE

EMV-Richtlinie 2004/108/EG
Niederspannungsrichtlinie 2006/95 EG
RoHS-Richtlinie 2011/65/EU

Made in Germany by

KEYBOARDPARTNER UG
Entwicklung elektronischer Musikinstrumente
Carsten Meyer ♦ Warneckeweg 12 ♦ D-31303 Burgdorf
Web: www.keyboardpartner.de Instructions: wiki.keyboardpartner.de
EMail: info@keyboardpartner.de

1.0 Jack Connections

HX3 Drawbar Expander connectors on back panel, left to right:

- **SWELL PEDAL** ¼” stereo jack. 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).
- **FOOT SWITCH** ¼” stereo jack. 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).
- **MIDI IN 1** Accepts MIDI data from master keyboard 1 or bass pedal
- **MIDI IN 2** Accepts MIDI data from master keyboard 2 or bass pedal
- **9V DC** 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: Plus on inner tip.
- **BASS** Separate audio output for bass pedal sound
- **MAIN** Organ output, either plain or with tube amp simulation, configurable
- **ROTARY SIM L** Audio output left channel of internal rotary simulation
- **ROTARY SIM R** Audio output right channel of internal rotary simulation
- **USB CONFIG** Port for PC connection to update HX3 sound engine or parameter tweaking
- **MIDI OUT** Sends MIDI data of Drawbar Expander’s own controllers
- **HEADPHONE** Stereo output of internal rotary simulation, headphone amplifier
- **ROTARY STATUS** 3 LEDs indicate status of external Leslie ®, green = on, red = slow, yellow = fast
- **EXTERNAL ROTARY** Standard 11-pin Leslie® speaker connector

1.1 Volume Control

Volume of all output channels is controlled by VOLUME knob on front or MIDI CC #7 “Volume”, whichever occurs last. Maximum output level of Leslie® connector is factory adjusted. It may be adjusted by service representative to your needs by two internal potentiometers.

Organ's **loudness** is controlled by an expression pedal or MIDI CC #11 “Expression”, whichever occurs last. HX3 resembles a loudness curve similar to the swell pedal of a classic tonewheel organ, 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 HX3 module.

Press menu panel encoder knob briefly to switch to **Rotary Tube Amp Gain** control and back. If gain is set to high levels, the simulated tube amplifier will distort/overdrive on full swell.

2. Panel Buttons

2.1 Tab Buttons

HX3 drawbar expander has two sets of drawbars for upper and lower manual as well as pedal and pedal sustain drawbars, and a set of 16 buttons. LED-illuminated buttons control main organ functions as found on a real B3:

- **PERCUSSION ON** toggles percussion on/off. When on, drawbar 1' is cancelled (see **No DB1 @Perc** parameter below to change cancelling behaviour)
- **PERCUSSION SOFT** toggles normal/soft percussion. Drawbar volume is muted in "normal" position
- **PERCUSSION FAST** toggles slow/fast percussion decay
- **PERCUSSION THIRD** toggles 2nd and 3rd percussion harmonic

Similar to Hammond® console organs, drawbar volume is muted in "normal" position to emphasise percussion effect. Muting level in "normal" position may be changed by menu.

- **VIBRATO UPPER** toggles vibrato on upper manual on/off
- **VIBRATO LOWER** toggles vibrato on lower manual on/off

Rotary buttons control both internal rotary simulation as well as a Leslie® speaker connected to 11-pin socket simultaneously. Rotary simulation may be controlled by footswitch or panel buttons alternatively. A flashing LED indicates rotary speed.

- **ROTARY RUN** toggles rotary motors on/off
- **ROTARY SPEED** toggles slow/fast rotary speed

HX3 Drawbar Expander does not provide a vibrato knob. Instead, 6 vibrato/chorus depths are set by 4 buttons:

- **VIBRATO V1** sets vibrato/chorus depth 1 (shallow)
- **VIBRATO V2** sets vibrato/chorus depth 2 (medium)
- **VIBRATO V3** sets vibrato/chorus depth 3 (deep)
- **VIBRATO CHORUS** toggles between vibrato and chorus mode

Vibrato setting does not have any effect if **VIBRATO UPPER** and **VIBRATO LOWER** are both off.

2.2 Effect/Configuration Buttons

Additionally, HX3 drawbar expander has buttons to control reverb, output configuration and manual split.

- **REVERB I** and **REVERB II** select 3 different reverb settings and reverb off. Press I and II simultaneously to select reverb III.
- **CONFIG A/B** selects one of the two pre-defined output configurations **A or B**. See section **Output Configuration Group** in section **Menu Panel** for details.
- **CONFIG SPLIT** sets keyboard split mode on or off.

Keyboard split default is **pedal mapped to lower manual** on first 25 keys (console organ pedal range, two octaves). Split mode may be changed by menu or by following procedure:

- Pedal to Lower: Press and hold desired **lower manual key** while switching **SPLIT** on to obtain a custom split point (useful for playing pedal bass lines on dual manual keyboards without bass pedals).
- Lower to Upper: Press a **single key** on **upper manual** while switching **SPLIT** on to map lower to upper manual up to this key (useful for playing 16’ bass lines or 4’ accompaniment chords on single manual keyboards).
- Pedal to Upper: Press **two keys** simultaneously on **upper manual** while switching **SPLIT** on to map pedal to upper manual up to highest of both keys pressed (useful for playing pedal bass lines on single manual keyboards without bass pedal).
- Lower to Upper +1: Press **three keys** simultaneously on **upper manual** while switching **SPLIT** on to map lower to upper manual up to highest of all keys pressed. Lower notes range is transposed one octave up (useful for left-hand 8’ accompaniment chords on single manual keyboards).
- Lower to Upper +2: Press **four keys** simultaneously on **upper manual** while switching **SPLIT** on to map lower to upper manual up to highest of all keys pressed. Lower notes range is transposed two octaves up (useful for left-hand 16’ accompaniment chords on single manual keyboards).

To save split mode and split point to power-on default, go to menu entry “Split Mode” and press encoder knob for 2 seconds. See **Menu Panel** section for details.

3. Menu Panel

The Menu Panel knob **Data Entry** (incremental encoder) will change drawbar preset numbers from 0 to 15, parameters in other menu entries or rotary TubeAmp Gain, depending on menu mode.

On power on, the **presets/drawbar menu** is present. Press knob briefly to switch to **Rotary Tube Amp Gain** control and back. Rotary Volume acts like the potentiometer found on classic Leslie™ cabinets: If set to high levels, the simulated tube amplifier begins to distort/overdrive on full swell.

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. LED buttons will show current percussion and vibrato setting.

Press Up/Down buttons several times to reach other menu entries (press and hold for auto-repeat). For faster access, upper drawbar settings are located on top of preset menu, lower drawbar settings and default settings are located below of preset menu.

- Use **Up/Down buttons** to scroll through menu items.
- 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 50 entries. A "<" arrow will direct to the parameter to be changed. Vertical arrows indicate if parameter is at limits or not.

3.1 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.
- **PXXLXXXXXXXX**- same for pedal (P) and lower (L) drawbars, incremental knob recalls preset.

3.2 Menus Defaults

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.

- **TubeAmp Gain**, sets volume of internal rotary tube amp simulation from 0 to full (overdriven tube amp). This menu entry may be reached directly from main menu by pressing encoder knob briefly.
- **Audio Jacks** - Switches between two output configurations A or B which may be configured separately in Defaults section (see below).

These parameters are saved to power-on defaults when encoder knob is pressed more than 2 seconds.

3.4.0 Commons Group

- **MIDI Channel** 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).
- **MIDI CC Set** sets recognized MIDI CC set to
  - 'NI B4' Native Instruments B4 (default),
  - 'Voce' MIDI drawbars,
  - 'Hamichord' (compatible with Mojo),
  - 'KeyB Duo',
  - 'Hammond XK',
  - 'Hammond SK' (Note: Hammond® changed MIDI CC set between XK and SK series, so try out which will fit), or
  - 'Custom CC' (must be configured with HX3 Remote App).
  - ‘NI B4 .’ to 'Custom CC .': Sostenuto enabled CC sets are marked with a full stop (dot). Per default, HX3 recognizes MIDI CC #64 as “Sustain”. Same sets as above with dot will recognize MIDI CC #64 as “Sostenuto”, so only notes played **while Sustain pedal is pressed down** are sustained.
- **SplitOption** default split setting on power-up, engaged when split set to ON.
  - 'PedalToLower', map pedal to lower manual up to split point
  - 'LowerToUpper', map lower to upper manual up to split point
  - 'PedalToUpper', map pedal to upper manual up to split point
  - 'LowerToU +1', map lower to upper manual up to split point, transpose lower +1 octave
  - 'LowerToU +2' map lower to upper manual up to split point, transpose lower +2 octave
- **Transpose** all manuals and pedal from -6 to +7 semitones. Notes beyond 5 octave limits of console organ will not produce any sound due to accuracy of physical model.

All these parameters are saved to power-on defaults when encoder knob is pressed more than 2 seconds (message will appear).

3.4.1 Output Configuration Group

HX3 generates five output signals: rotary stereo simulation left/right, plain organ, bass pedal, and organ with rotary 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) or Rotary switch on button panel. Factory default is set to match rear panel jack lettering.

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 simulation 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.

Configuration	Audio 1	Audio 2	Extension 3	Extension 4
ORG/PD - L/R	Organ Plain	Pedal	Rotary Left	Rotary Right
PD/ORG - R/L	Pedal	Organ Plain	Rotary Right	Rotary Left
L/R - ORG/PD	Rotary Left	Rotary Right	Organ Plain	Pedal
R/L - PD/ORG	Rotary Right	Rotary Left	Pedal	Organ Plain
ORG/L - PD/R	Organ	Rotary Left	Pedal	Rotary Right
L/ORG - R/PD	Rotary Left	Organ Plain	Rotary Right	Pedal
PD/R - ORG/L	Pedal	Rotary Right	Organ Plain	Rotary Left
R/PD - L/ORG	Rotary Right	Pedal	Rotary Left	Organ Plain
AMP/PD - L/R	**Organ AmpSim**	**Pedal**	**Rotary Left**	**Rotary Right**
PD/AMP - R/L	Pedal	Organ AmpSim	Rotary Right	Rotary Left
L/R - AMP/PD	Rotary Left	Rotary Right	Organ AmpSim	Pedal
R/L - PD/AMP	Rotary Right	Rotary Left	Pedal	Organ AmpSim
AMP/L - PD/R	Organ AmpSim	Rotary Left	Pedal	Rotary Right
L/AMP - R/PD	Rotary Left	Organ AmpSim	Rotary Right	Pedal
PD/R - AMP/L	Pedal	Rotary Right	Organ AmpSim	Rotary Left
R/PD - L/AMP	Rotary Right	Pedal	Rotary Left	Organ AmpSim

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

3.4.2 Vibrato Group

- **Vib1** adjusts amplitude modulation and reflections caused by delay line on V1/C1 knob setting.
- **Vib1 FreqMod** adjusts frequency modulation on V1/C1 knob setting.
- **Vib2 Age** adjusts amplitude modulation caused by delay line on V2/C2 knob setting.
- **Vib2 FreqMod** adjusts frequency modulation on V2/C2 knob setting.
- **Vib3 Age** adjusts amplitude modulation and reflections caused by delay line on V3/C3 knob setting.
- **Vib3 FreqMod** adjusts frequency modulation on V3/C3 knob setting.
- **ChorDryMix** adjusts vibrato chorus mix dry (unmodulated) part in C1/C2/C3 setting.
- **ChorVibMix** adjusts vibrato chorus mix wet (FM/AM modulated) part in C1/C2/C3 setting.
- **PercNormLvl** adjusts percussion level in PERC ON, NORMAL tab setting.
- **PercSoftLvl** adjusts percussion level in PERC ON, SOFT tab setting.
- **PercLongTm** adjusts percussion decay rate in PERC ON, SLOW tab setting (higher value = faster).
- **PercShortTm** adjusts percussion decay rate in PERC ON, FAST tab setting (higher value = faster).
- **PercMutedDB** adjusts drawbar muting when percussion normal is on (no muting when value = 250).

3.4.3 Generator Group

- **TG Flutter** adjusts tone generator "sloppyness" (spring clutch tension, bearing precision).
- **TG Leakage** 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 Cap Set** sets tone generator capacitor age. Older caps yield a more mellow sound.
- **No DB1 @Perc** enables drawbar 1 cancel when percussion ON (as original B3®)
- **DB16 1st Oct** controls harmonic 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") with muted level.
- **ToneTrimPot** mimics TONE pot on Hammond® AO28 amp; well, a little bit more on high values.
- **SwellTrimCap** adjusts trim cap setting in AO28 swell assembly. Higher values yield more volume and more AO28 output transformer saturation.
- **AO28 TubeAge** controls simulated AO28 preamp tube aging (higher triode distortion k2).

- **ContSpringFlx** adjusts key contact spring flex, affects click length.
- **ContSpringDmp** adjusts key contact spring damping, affects click frequency.

3.4.4 Reverb Group

- **Reverb 1 Lvl** controls reverb amount and length on Reverb program 1 setting.
- **Reverb 2 Lvl** controls reverb amount and length on Reverb program 2 setting.
- **Reverb 3 Lvl** controls reverb amount and length on Reverb program 3 setting.

3.4.5 Rotary Group

- **Rotary Throb** controls “throb” effect on rotary speaker simulation. Higher values give a deeper acoustical beam modulation (closer microphone position).
- **Rotary Spread** controls rotary simulation stereo spread (stereo width).
- **Rotary Balnce** controls rotary simulation volume balance horn/rotor.

If a “Sostenuto” enabled CC set is selected, HX3 will translate MIDI CC #64 “Sustain” to “Sostenuto”, so only notes played **while Sustain pedal is pressed down** are sustained. HX3 will not recognize MIDI CC #66 as sostenuto as this CC number is occupied by NI B4 percussion setting.

All these parameters are saved to power-on defaults when encoder knob is pressed more than 2 seconds (message will appear).

3.5 Factory Reset

In rare circumstances (like static discharge or overvoltage) a loss of internal settings may occur. If you experience any misbehaviour, press the MenuPanel knob when powering on until “Factory Reset” prompt appears to retrieve the factory defaults. Then confirm by pressing “up” button.

4. 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. SysEx data is always ignored. HX3 drawbar expander has 2 independent MIDI inputs for connection of two master keyboards or keyboard and bass pedal. MIDI OUT on Extension board (optional) transmits all MIDI CC controller data according to NI B4 standard, independent of selected MIDI receive CC set.

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.

4.0 General

Connect MIDI out of your MIDI controller or master keyboard to HX3 MIDI input. HX3 does not introduce any audio latency, so delays are only due to MIDI transmission.

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 using the directly attached swell pedal, MIDI expression messages are accepted.

Note: Some MIDI controllers as well as organ keyboards (like Hammond® XK 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.

4.1 Loudness and Volume Control

Organ's **loudness** is controlled by 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. MIDI CC #7 controls the master volume which affects all 4 output jacks and headphone output as well as Leslie® speaker connected to 11-pin socket.

5. HX3 Apps

HX3 Remote for Windows application is a convenient way to update or maintain your HX3 drawbar expander. It allows for firmware and sound engine updates, parameter tweaking and preset setup for experienced users.

HX3 Update for Windows application is a "one click solution" to update your HX3 mk2/mk3/mk4 board or expander.

Both programs and complete documentation are available through our wiki pages on

http://wiki.keyboardpartner.de

Join the HX3 community at http://forum.keyboardpartner.de!

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Entwicklung elektronischer Musikinstrumente
Carsten Meyer ♦ Warneckeweg 12 ♦ D-31303 Burgdorf
Web: www.keyboardpartner.de Instructions: wiki.keyboardpartner.de
EMail: info@keyboardpartner.de