KEYBOARDPARTNER UG

HX3 Drawbar Expander Version 4.25

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 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 modelling
- Tunable in range of A = 433 through 447 Hz
- 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.

All information given herein is given to describe certain components and shall not be considered as a guarantee of characteristics. Rights to technical changes reserved.

EU conformity declaration

This device conforms to EU regulations

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

Made in Germany by

KEYBOARDPARTNER UG

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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 remote controlled by MIDI control change, controller 11). Plug connection: Sleeve = ground / potentiometer start, ring = potentiometer tap, tip = potentiometer end.
- **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** Mini USB connector for updates and configuration by *HX3 Remote* or *HX3 Flash* application. Not suitable for MIDI over USB.
- **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

Output level 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 **swell pedal** position 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.

MIDI CC #11 and #7 may be changed by menu to any other valid MIDI CC number.

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 emphasize 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

Six vibrato/chorus variations 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 one of the following procedures:

- **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.

3.0 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 will 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 Defaults Group

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.
- **ToneTrimPot** mimics TONE pot on simulated AO28 amp; well, a little bit more on high values.
- **Reverb Prgm** selects one of 3 different reverb programs. For each program, amount of reverb may be adjusted.
    - **Reverb Lvl 1** reverb amount of reverb program 1
    - **Reverb Lvl 2** reverb amount of reverb program 2
    - **Reverb Lvl 3** reverb amount of reverb program 3

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

3.2.1 Split Configuration

Keyboard split default is pedal mapped to lower manual on first 25 keys (console organ pedal range, two octaves). To save split mode and split point to power-on default, go to menu entry “Split Mode” and press encoder knob for 2 seconds. Default split modes may be changed by menu:

- **Split Manual** switches split mode on or off.
- **Split Mode** 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
- **Split Point** sets split point (when split is on) as key number (24 is second „C“ on manual).

All these parameters are saved to power-on defaults if encoder knob is pressed more than 2 seconds (message will appear). Split mode may also be changed as described in chapter **2.2 Effect/Configuration Buttons.**

3.2.2 Output Configuration

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. Factory default is set to match rear panel jack lettering.

- **Audio Jacks** - Switches between two output configurations **Config A** or **Config B** which may be configured separately.
- **AudioJ Conf A** sets audio jack configuration A and
- **AudioJ Conf B** sets audio jack configuration B according to table below.

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.

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.

3.2.3 Commons Group

- **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.
- **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.
- **MIDI Swell CC** sets accepted swell/expression CC number (default #11).
- **MIDI VolumeCC** sets accepted overall volume CC number (default #7).

3.2.4 Vibrato Group

Detailed modelling of scanner vibrato yields lots of adjustable parameters. Avoid to randomly change parameters as they are intended for real organ enthusiasts – you should know what you're doing.

- **Scanner Gears** adjusts scanner drive gearing and therefore vibrato frequency.
- **Scanner Leak** adjuste leakage of higher notes in scanner compartment due to parasitic capacitances.
- **VibCh AmplMod** adjusts amplitude modulation caused by delay line on all vibrato/chorus knob settings.
- **VibCh PreEmph** adjusts treble increase when vibrato/chorus is switched on. Effect on chorus is obvious, while increase on Vibrato is more subtile.
- **VibCh Reflect** sets amount of reflected signal on LC linebox due to aged caps. Higher values will lead to a ‚celeste'-like effect as found on model M100.
- **VibCh Response** sets upper frequency response of LC linebox.
- **Ch LineboxLvl** adjusts ‚wet' modulated amount when in chorus mode.
- **Ch BypassLvl** adusts ‚dry' unmodulated amount when in chorus mode.
- **V1..C3 ModAmount** sets modulation amount for each vibrato knob setting (6 menus)

3.2.5 Percussion Group

- **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).
- **PercMuteDB** sets drawbar muting amount while in Perc NORM. No mute will happen if value set to 250.

3.2.6 Generator Group

- **TG Gears Tune** sets organ generator tuning in range from A = 433 through 447 Hz
- **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 CapSet** sets tone generator age to vintage
    - 1955 (very aged caps, mellow sound)
    - 1961 (aged wax caps, jazz-type sound)
    - 1972 (new “red” caps, rock-type sound)
    - Recapped (more aggressive).

- **No DB1 @Perc** 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.

3.2.7 Preamp Group and Misc.

Along with ToneTrimPot (see above), adjusts behaviour and response of the famous AO28 preamp chassis including transformer/tube saturation.

- **SwellTrimCap** adjusts organ oputput volume like the trim cap in B3 swell pedal control. Higher values add more punch and output transformer saturation effects.
- **AO28 TubeAge** controls simulated AO28 preamp tube aging (higher triode distortion k2 in 12BH7 output stage).

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

3.3 Rotary Group

A few common parameters for rotary sim are available on menu. HX3 imlements a 4-beam direct/reflection model along with 512-pole FIR filter for horn simulation and a separate 2-beam direct/reflection model for rotor simulation. Most of parameters are editable through *HX3 Remote* application; avoid to randomly change parameters in *HX3 Remote* as they are intended for developers and OEMs – you should know what you're doing.

- **HornSlowTm** Rotary simulation horn revolution timer when set to SLOW
- **RotorSlowTm** Rotary simulation rotor revolution timer when set to SLOW
- **HornFastTm** Rotary simulation horn revolution timer when set to FAST
- **RotorFastTm** Rotary simulation rotor revolution timer when set to FAST
- **HornRampUp** Rotary simulation horn accelleration from SLOW to FAST.
- **RotorRampUp** Rotary simulation rotor accelleration from SLOW to FAST.
- **HornRampDown** Rotary simulation horn brake time from FAST to SLOW.
- **RotorRampDown** Rotary simulation rotor brake time from FAST to SLOW.
- **Rotary Throb** Rotary simulation "throb" modulation factor
- **Rotary Spread** Rotary simulation stereo spread (width).
- **Rotary Balnce** Rotary simulation volume balance horn/rotor.

3.4 Factory Reset

All parameter changes are saved permanently by pressing the MenuPanel knob for more than 2 seconds. To retrieve the factory defaults, press the MenuPanel encoder knob when powering on until "Factory Reset" prompt appears, then confirm by pressing "up" button.

3.5 Serial Numbers and Licences

HX3 is protected agains forging by licence numbers. If not set appropriately after firmware update, HX3 will refuse to word after 2 minutes. Licences may be re-installed at any time. Please contact KeyboardPartner to obtain a valid licence key. We need your serial number (issued on startup and by *HX3 Remote* application) to generate new licences for you.

4.0 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. MIDI dynamics slightly influences key click noise. 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 remote-controlled 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

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.

Since MIDI is 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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