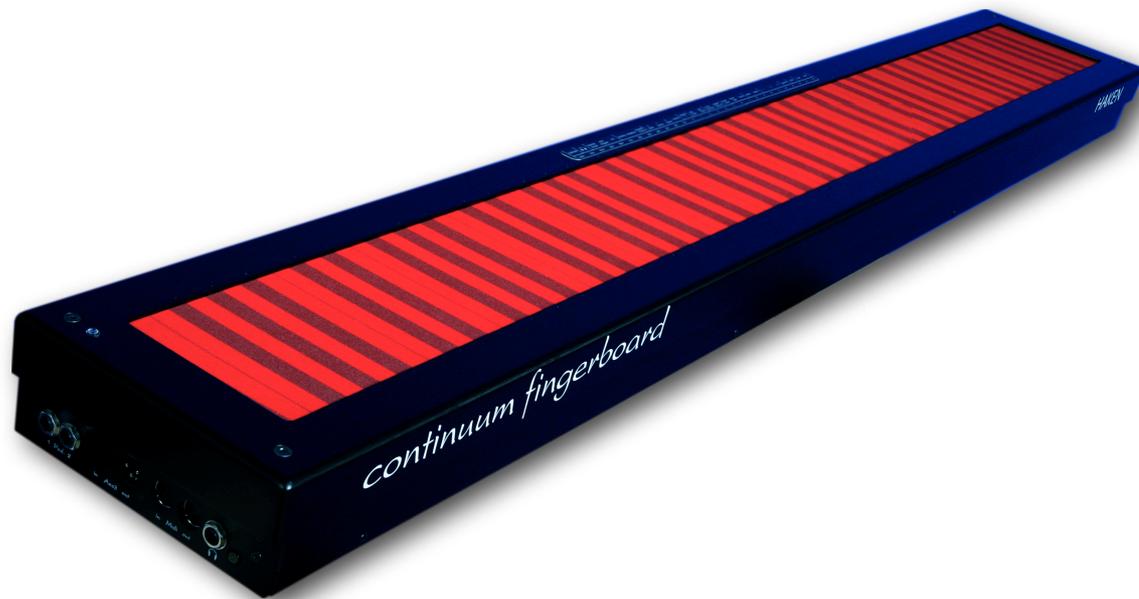


# Continuum Fingerboard User's Guide

March 4, 2013

Firmware Version 5.50



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## About this document

This Continuum Fingerboard User's Guide has been formatted so that it is easy to read both in printed form and online. Each page will fit on a standard sized computer monitor. The current version of this document can be found online in the Resources section of [www.HakenAudio.com](http://www.HakenAudio.com). We suggest new Continuum Fingerboard owners read this guide at least up to Section 7.1. The knowledge you gain will save you time in the future and significantly enhance your experience with your Continuum Fingerboard. After you finish reading this guide, please keep it available as a reference.

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## Legal

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# 1 Overview of the Continuum Fingerboard

The Haken Audio Continuum Fingerboard tracks the position and pressure of fingers on its playing surface. Unlike a Midi keyboard, which only starts and stops notes, the Continuum Fingerboard lets the performer intimately interact with the sound throughout every note, breathing life and expression into the musical performance.

The Continuum Fingerboard is neither an easy-to-use gadget nor a device for replacing keyboards and acoustic instruments; instead, it is a new instrument in its own right, with immediate appeal as well as lifelong challenges for the serious musician.

The Continuum Fingerboard has a built-in synthesizer specifically designed for Continuum playing. The internal synthesizer has predefined sounds as well as user-defined sounds. Stereo output from the internal synthesizer can be heard through the analog headphone outputs and the AES digital audio outputs.

A graphic user interface, the Continuum Editor (for Mac and Windows), connects to the Continuum Fingerboard via Midi. External synthesizers may also be connected via Midi, or using analog control voltages from the Continuum Voltage Converter.



## 1.1 EaganMatrix

The EaganMatrix is the modular digital synthesizer built into the Continuum Fingerboard.

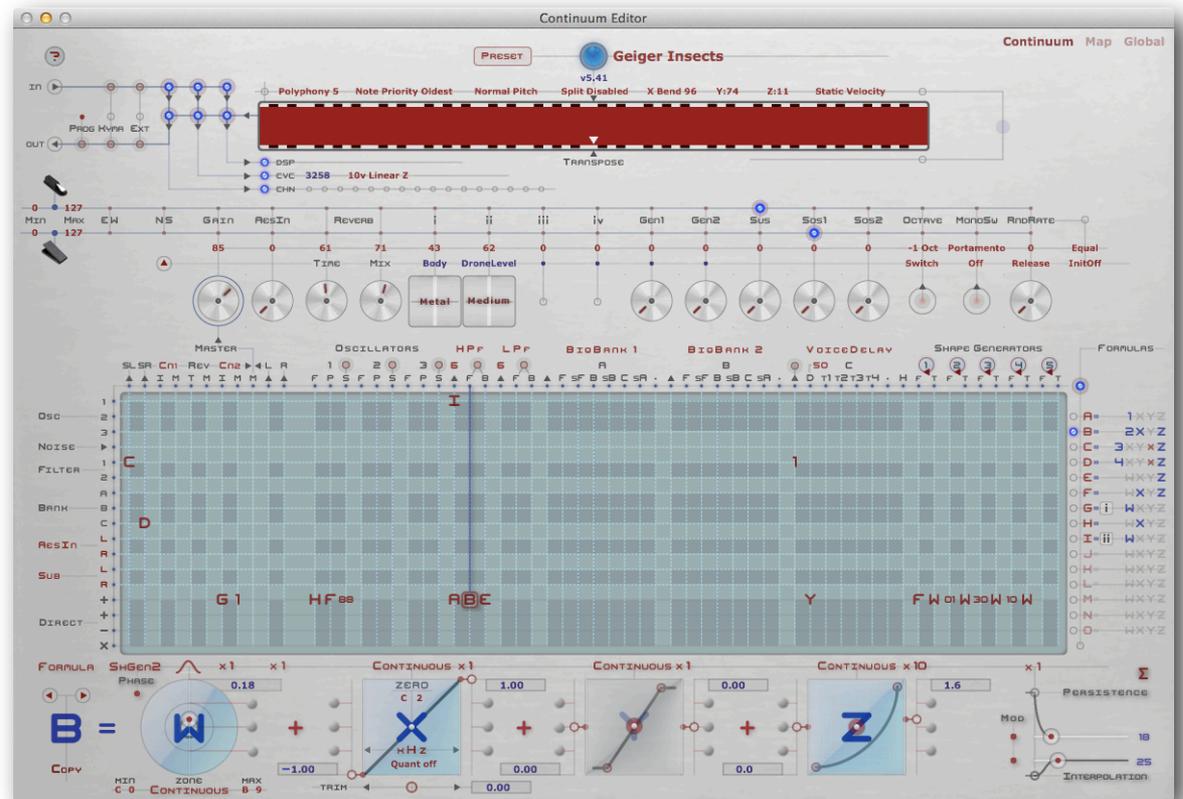
### For the Performer

Many new sound algorithms have been finely crafted with the EaganMatrix. These EaganMatrix Presets exploit the unprecedented control possible with the Continuum Fingerboard. They provide the performer with an ever-increasing set of sophisticated sound environments to shape and explore using novel finger techniques.

### For the Sound Designer

Not only does the EaganMatrix provide a large number of new Presets for the performer, it is also a fantastic tool for the sound designer. The Continuum Editor provides the EaganMatrix user interface. Since the EaganMatrix requires no external synthesizer, sound designs can easily be shared with other Continuum Fingerboard players.

The radically new design of the EaganMatrix requires the sound designer to think in a mathematical way that is different from traditional hardware and software synthesizers. As the sound designer masters the EaganMatrix, its new capabilities will allow creation of musically satisfying relationships between fingers on the playing surface and the sounds produced, relationships that rival the warmth and complexity of acoustic instruments. For more information, please see the EaganMatrix User's Guide available in the Resources area at [www.HakenAudio.com](http://www.HakenAudio.com).



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## 1.2 Continuum Voltage Converter



Haken Audio's Continuum Voltage Converter is designed for use with analog control-voltage synthesizers. The CVC converts the polyphonic X (pitch), Y (front-back), and Z (pressure) outputs of the Continuum Fingerboard into control voltages and gates. Alternatively, user-defined preprocessed control voltages can be defined with the EganMatrix.

A total of 16 unique continuous voltage streams are available from a single CVC. Two CVCs can be connected together for additional polyphony.

For more information, please see the CVC User's Guide available in the Resources area at [www.HakenAudio.com](http://www.HakenAudio.com).

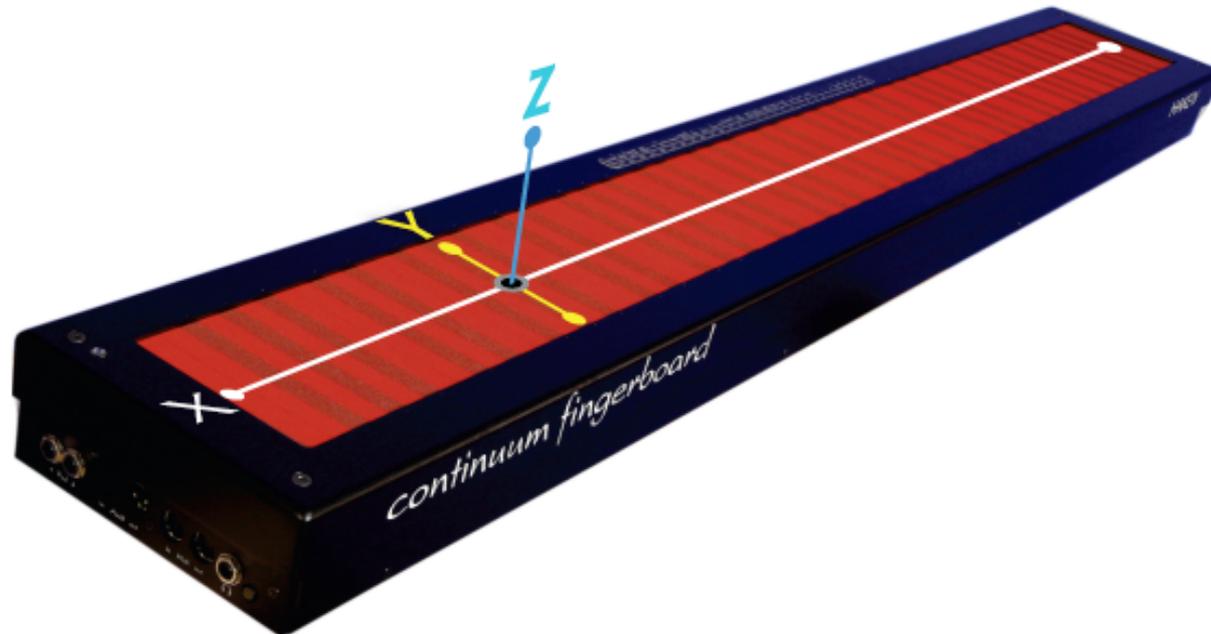
## 1.3 Midi Encoding

The Continuum Fingerboard assigns each finger on the playing surface its own Midi channel. By default it tracks 8 fingers, using Midi channels 1-8. It may be configured to track between 1 and up to 16 fingers.

It tracks pitch (X), front-back position (Y), and pressure (Z) for each finger. The exact pitch of each finger is encoded as the nearest Midi note number to the initial position of the finger, plus the Pitch Bend on the finger's Midi channel. Note numbers range from 15 to 109 on a full-size Continuum Fingerboard, and from 39 to 85 on a half-size Continuum Fingerboard. Note number range can be changed by transposing or scaling the range of the Continuum Fingerboard. This is accomplished by selecting a new Middle C location or a custom tuning, as described in Section 4. The default Pitch Bend range is two octaves. The default encoding for finger pressure uses Midi controller 11 (Expression), and the default encoding for front-to-back uses Midi controller 74 (Brightness).

Other configuration options provide alternative encoding of finger pressure as a different continuous controller, and alternative continuous controllers for encoding the front-to-back position of each finger.

Continuum Fingerboard configuration changes may be made three ways: using the Continuum Fingerboard's playing surface (Section 4), using the Continuum Editor computer application (Section 4), or by sending Midi configuration messages to the Continuum Fingerboard (Section 7.4).



## 1.4 Kyma Encoding



If you use Symbolic Sound Corporation's Kyma with your Continuum Fingerboard, each finger's position and pressure is available in standard Kyma Midi-event values of !KeyPitch (left-to-right position), !KeyTimbre (front-to-back position), and !KeyVelocity (finger pressure). These values continually change as the fingers move. Note that !KeyPitch is Midi note numbers, with fractional value to indicate exact finger position.

The start of each finger's placement on the Continuum Fingerboard surface is interpreted as a !KeyDown. Kyma will send Midi information back to the Continuum which will automatically configure the polyphony of the Continuum Fingerboard surface to match the currently playing Kyma sound. Kyma uses the default Continuum Fingerboard cc values for Y and Z, and will automatically configure the Continuum accordingly.

It is sometimes useful to smooth !KeyVelocity (finger pressure) when you use it in Kyma. Undesirable audible effects can be caused by the Continuum Fingerboard's scan rate, or the parameter updates at Midi transmission rate. Continuous event smoothing is available globally within the Kyma system preferences.

To get the quickest real-time response from Kyma, choose the shortest Overall System Delay that works for your Sound (also in the Kyma preferences).

See Section 4.18 for required Kyma-specific configuration Option 10; or use the Editor options as described in Section 3.3.



## 1.5 Connections

Connections are made to the Continuum Fingerboard on both the left end and the right end of the instrument.



Left End of Continuum Fingerboard	
1	LED. Changes color depending on calibration or configuration state, via pressing the Red Button (9) or interaction through Continuum Editor and external Midi configuration.
2	Pedal 1 input. Connect a standard passive switch, damper pedal, or passive continuous pedal.
3	Pedal 2 input. Connect a standard passive switch, damper pedal, or passive continuous pedal.
4	Digital audio input (AES3 format).
5	Digital audio output (AES3 format).
6	Midi input.
7	Midi output and CVC control output.
8	Analog audio out, headphone level. TRS Stereo jack.
9	The Red Button, used for configuration and calibration procedures.
Right End of Continuum Fingerboard	
10	Power plug (110/220v, 50-60hz)
11	Fuse (4 amp)
12	On/Off switch

## 1.6 Hardware Specifications

	Full Size	Half Size
Pitch Range	Nearly 8 octaves (9350 cents)	Nearly 4 octaves (4610 cents)
Polyphony	Internal maximum 32, Midi maximum 16	
Pitch Resolution	Better than 1 cent	
Scan Interval	330 microseconds minimum	
Size	135 19 7.5 cm (54 7.5 3 in)	71 19 7.5 cm (28.4 7.5 3 in)
Hard Case Size	150 28 16.5 cm (59 11 6.5 in)	86 28 16.5 cm (34 11 6.5 in)
Heavy Case Size	150 26.5 20 cm (59 10.5 8 in)	86 26.5 20 cm (34 10.5 8 in)
Weight	10.2 kg (22.5 lbs)	7.3 kg (16 lbs)
with Hard Case	17 kg (38 lbs)	11.2 kg (25 lbs)
with Heavy Case	23.3 kg (52 lbs)	14.8 kg (33 lbs)
Power	50 watts, 110 or 220 vac	40 watts, 110 or 220 vac
Interface	Midi, headphone, AES3, i2c for CVC	
Audio Output (Analog)	24 bit D/A, up to 5.1v p-p, 100 mW power	
Audio Output (Digital)	24 bit AES3, 48 or 96 kHz sample rate or sync to AES3 input	
Audio Input (Digital)	24 bit AES3, sample rates from 32 to 192 kHz	

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## 1.7 Turning On the Continuum Fingerboard

The Continuum Fingerboard should be placed on a solid stand or table. The stand or table should not appreciably move when vibrato or other finger motions occur on the playing surface. Many performers prefer the Continuum Fingerboard at a slight angle; for ideas please see the description of Edmund Eagan's Continuum Stand in the Accessories area of [www.HakenAudio.com](http://www.HakenAudio.com).

When you plug in the Continuum Fingerboard and turn it on, the LED should light within two seconds. If it doesn't, please turn it off and check the power connection and then the fuse. If you repeatedly blow fuses, please contact technical support; this indicates a serious problem.

The Continuum Fingerboard will be slightly warm to the touch if it has been turned on for a while. This is normal and does not indicate a problem.

When you first receive your Continuum Fingerboard, you must follow the calibration procedure in Section 2 of this guide. After you complete the calibration, connect a Midi interface between your Continuum and your Mac or PC, and run the Continuum Editor (see Section 3 for setup details). You will want to use high efficiency headphones with your Continuum's headphone jack. *Take care when you first put on your headphones; verify that the Gain setting is appropriate. Refer to Sections 3 and 4.1 to learn how to set the Gain.* The Continuum Fingerboard's headphone jack is capable of a wide output voltage range, and can optionally be used for professional-level audio line level output.

We suggest you play with the Continuum Fingerboard's built-in sounds before connecting external synthesizers, and get used to the feel and operation of the playing surface.



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## 1.8 Playing the Continuum Fingerboard

Performing on the Continuum Fingerboard is challenging. Like a fretless instrument, you must rely on audio feedback, finger memory and manual dexterity for accurate intonation and expression. You will find that the Continuum Fingerboard requires its own technique, different from any other instrument.

When you play a traditional music keyboard, it is normal to feel the key hit a hard stop as you play a note, even if you are playing quietly. Also, traditional keyboards are usually velocity sensitive. On an instrument like a piano, a single velocity value is transmitted from the speed of the key movement.

In contrast, the Continuum Fingerboard is both velocity sensitive and, more importantly, pressure sensitive. It initially outputs a single velocity level, then continually outputs a stream of pressure values. These pressure values continue as pressure changes until the note is terminated. It is unusual to hit the hard stop (or "bottom out") except for the very loudest notes. This distance from zero pressure to maximum pressure is small, yet offers an extremely wide range of dynamic possibilities. The lighter the touch you master on the Continuum Fingerboard, the greater the expressive possibilities it will offer you. Even if you have a refined keyboard technique on a piano or synthesizer you will still need to develop new playing skills to master the Continuum Fingerboard.

Don't assume that the Continuum Fingerboard will respond like a pressure sensitive drum pad. The Continuum Fingerboard playing surface has been designed for a finger technique. The human hand is an extremely sensitive input/output device. Thanks to the Continuum Fingerboard's design the performer is free from the greater mechanical forces that are required to actuate a note on an acoustic keyboard instrument like a piano or harpsichord. As such, the mechanical feedback devices inside the Continuum Fingerboard are designed to take advantage of the lighter pressures that a human hand can easily and quickly generate. Keep this in mind as you play your Continuum Fingerboard. You'll be rewarded with a decidedly musical response to your subtle and dynamic playing gestures. A lighter touch will also minimize heat buildup on the fingertips that can be caused by overly aggressive contact with the surface.

As a suggestion, start playing the Continuum Fingerboard with just one note at a time; leave the chords until later. Practice vibrato and dynamic variations. Try to imitate the expressive playing of other performers on other instruments; a favorite is to imitate [Clara Rockmore](#) playing Rachmaninoff on the Theremin. When you start playing chords, start simple and listen to the beats adjust as you roll your fingers on the playing surface. Try playing drone tones and add a melody. Practice just intonation and alternate tunings.

Chords containing half-step intervals present a particular challenge. When you place fingers closely together (less than 150 cents apart) on the playing surface, the Continuum Fingerboard can have trouble resolving the two fingers. This may result in a smaller pitch interval than you expect, or it may result in a single finger (not two fingers) being detected. With practice you can reliably play half-step intervals.

If playing chords with smaller than 100 cent intervals is of interest to you, and if you learn how to program the EaganMatrix or have an external flexible synthesis system, one approach is to have the front-back position enable an octave shift in your synthesis system. This will allow you to play tiny intervals and unisons by placing fingers an octave apart at the front and back of the playing surface. Another approach is to use a Sustain Pedal to build up a tone cluster from several closely spaced pitches that you touch one at a time. A third approach is to define a custom tuning that stretches half steps or repeats the same pitches at two locations on the playing surface (see Section 8).

## 1.9 Mono Transitions

The Continuum Fingerboard tracks up to 16 fingers on its playing surface. When multiple fingers are touching the surface, each finger can trigger its own note, or the combination of fingers can correspond to a single note. This is called Mono on the Continuum Fingerboard. Mono is a very powerful performance feature. It can be used for playing single-note lines with articulation reminiscent of wind instruments, or for oscillating back and forth accurately between two pitch centers.

### Mono Functions

The Continuum Fingerboard supplies six Mono Functions that allow you to perform single-note lines with a variety of transitions between notes. If one finger is down, and another is pressed, the Continuum can convert this information into two consecutive single notes with one of the following transitions between the notes:

Function Type	Details	Midi Encoding
<b>Portamento</b>	The second note has no attack or decay of its own; instead, it continues with the sustain portion of the first note, but smoothly glides to the new pitch.	A highly optimized series of Pitch Bend messages will be used to glide the pitch to the new note.
<b>Legato Z</b>	The second note has no attack or decay of its own; instead, it continues with the sustain portion of the first note, but jumps to the new pitch.	When the second finger reaches a pressure greater than the first, a Pitch Bend will be used to jump to the new pitch; no Note Off or Note On will be transmitted.
<b>Retrigger Z</b>	The second note has an attack and decay; it sounds much like it would if the first note had not been played.	When the second finger reaches a pressure greater than the first, a Note Off will be transmitted for the first finger, and a Note On for the second finger.
<b>Legato T</b>	The second note has no attack or decay of its own; instead, it continues with the sustain portion of the first note, but jumps to the new pitch.	As soon as the second finger touches the surface, a Pitch Bend will be used to jump to the new pitch; no Note Off or Note On will be transmitted.
<b>Retrig New</b>	The second note has an attack and decay; it sounds much like it would if the first note had not been played. If the second finger is lifted before the first, the pitch jumps back to the first finger's pitch.	As soon as the second finger touches the surface, a Note Off will be transmitted for the first finger, and a Note On for the second finger. Then, if the second finger is lifted before the first, a Pitch Bend will be used to jump back to the first finger's pitch.

Function Type	Details	Midi Encoding
<b>Retrig All</b>	The second note has an attack and decay; it sounds much like it would if the first note had not been played. If the second finger is lifted before the first, the first note re-attacks.	As soon as the second finger touches the surface, a Note Off will be transmitted for the first finger, and a Note On for the second finger. If the second finger is lifted before the first, a Note Off will be transmitted for the second finger, and a new Note On will be transmitted for the first finger.

### **Finger Pressure and Mono Transitions**

Mono transitions can be controlled by finger pressure or by time. If one finger is pressed down, and then a second is pressed down in addition to the first, the transition is as follows:

Portamento: The transition begins when the second finger touches the surface (the pitch glide begins), and ends when the first finger is lifted (the pitch glide is completed). The pressure of each finger, as well as the pitch of each finger, determines the pitch played during the transition. Long and short transitions may be performed under control of finger pressure, without changing any externally configured parameters. The pitch glide rate may vary within a single transition, depending on how the performer adjusts the relative finger pressures. If many fingers are down, the pitches and the pressures of each finger are combined to compute the total pitch. The variable nature of this pitch glide allows the performer to create complex glide curves that would be difficult if not impossible to program into a conventional synthesizer.

Legato Z and Retrigger Z: The transition occurs when the second finger reaches a higher pressure than the first. If many fingers are down, the finger with the highest pressure is played; if fingers are changing pressure, transitions occur whenever a new finger becomes the finger with highest pressure.

Legato T and Retrig New and Retrig All: The transition occurs as soon as the second finger touches the surface. If many fingers are down, the last finger to touch the surface is played.

### **Selecting Mono**

Mono is selected in the following three situations:

- (1) The Continuum Fingerboard has polyphony 1. Multiple fingers are tracked, but only one note at a time is played on the synthesizer. Only single-note lines can be played, with Mono transitions between the notes.
- (2) The Continuum Fingerboard has polyphony greater than 1, but the surface is split so that only one voice is assigned to a range of pitches. Within that pitch range, Mono is used, and only single-note lines can be played in that range.
- (3) Polyphony is greater than 1, and the Mono Interval (the pitch interval within which single-note transitions will occur) has been configured. If the second finger is within the Mono Interval of the first finger, a single-note line will be played. If the second finger is outside

the Mono Interval of the first finger, multiple notes will sound at once. This feature can be selectively enabled and disabled during a performance using the Mono Switch pedal, allowing a performer to play (for example) both mono mordents and polyphonic mordents.

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## 1.10 Rounding and the Tuning Grid

### **Rounding**

The Continuum Fingerboard includes a sophisticated mechanism to quantize finger positions to predetermined scale grids, such as equally tempered or just tuning grids. It allows you to place fingers with positional errors, and still hear a note (or a chord, if you are playing polyphonically) that corresponds to perfectly placed fingers. You may then slide your fingers (glissando) to new positions; the notes will glide in pitch to the new finger positions, and then they will be corrected. When finger positions are corrected, we refer to this as “rounding the finger position”. Finger position may be corrected when the finger first touches the surface (Round Initial), and after the finger slides on the surface (Round Rate). The Round Rate mechanism works in such a way as to not diminish the expressive possibilities of subtle pitch changes like vibrato (periodic variation in pitch), grace notes (small glissandi) or large pitch sweeps. For instance, if a note is played with vibrato, small adjustments will be made so that the averaged finger position (and the perceived pitch) is precisely correct.

The Round Rate mechanism allows you to control the rate at which finger position correction drifts toward the tuning grid, anywhere from instantaneous to glacial. A Round Rate of 0 means no rounding; small Round Rates cause a slow drift to grid positions; larger rates round more quickly. The maximum Round Rate of 127 causes immediate rounding; with this rate you will get a fretted guitar style half-step glissando when you slide a finger over adjacent grid positions.

The Round Rate mechanism not only corrects finger position while the finger is in contact with the surface, it continues to correct even after the finger is lifted from the surface (during the release portion of the note).

The Round Rate can be modified at any time during a performance. You can configure the Round Rate using the Continuum Editor or the Configuration Strip (see Section 4.15). You can also change the Round Rate using pedals or Midi In (see Section 7.1).

### **Tuning Grid**

The Continuum Fingerboard allows you to choose between Just tuning, equal tuning, N Division tuning, and user-defined custom tunings for correcting finger positions via Rounding. In the Just tuning, any of the major triads (I, IV, V) will have perfect 4:5:6 frequency ratios in the rounded finger position, and the ii and vi minor triads will have perfect 10:12:15 frequency ratios. You can change the tonic key for the tuning at any time, even while fingers are pressing on the Continuum Fingerboard's playing surface; the Round Rate mechanism will correct the positions of those fingers to the new tuning. As in equal temperament tuning the time the tuning rounding takes is dependent on setting of Round Rate. N Division tuning rounds the surface to a number of divisions of each octave on the playing surface, based on all the C pitches. For instance, an N Division setting of 1 will round every finger position to the closest C note. An N Division setting of 2 will round each finger to the closest C or F#, whichever is closest. An N Division setting of 24 will round each finger to the closest quarter step. User-

defined custom tuning grids provide many additional capabilities, including the ability to stretch or shrink the size of octaves, tune in reverse, repeat the same pitches at different points on the surface, or define your own versions of Just and other tunings.

For more detailed explanations of Tuning Grids refer to Section 8.

### **Disadvantages of Rounding**

Ideally, the Continuum Fingerboard is played without the idea of a predetermined scale. A skilled violinist is not constrained to pitches from a particular scale during a performance; instead, the violinist micro-adjusts the pitch of each note for optimal musical results. Similarly, a skilled Continuum player is constantly listening and adjusting finger position to obtain the desired results, and does not rely on the Round Rate mechanism to make up for inability to place fingers properly. For beginners, the Continuum's Rounding feature seems to be helpful, but the short-term convenience will eventually have long-term consequences. Important finger placement, muscle memory, and listening skills will be compromised. A Continuum player that requires Round Rate is a bit like a singer that requires auto-tune to sing in tune.

### **Release Rounding**

Release Rounding is different from the Continuum's other Rounding mechanisms. Release Rounding limits the effect of Round Rate so that it only adjusts pitch once a performer's finger is lifted, but has no effect while the finger is touching the surface. Once the finger is lifted from the Continuum's surface and the note is still sounding through a release envelope, a performer can no longer correct an "out of pitch" note. Release Rounding is valuable for timbres which are plucked and have a long release after the finger is lifted, such as the Continuum's internal sound Metal Bar. Release Rounding may be of interest to Continuum players who otherwise avoid the Round Rate mechanisms.

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## 1.11 Connecting an External Midi Synthesizer

In addition to playing internal sounds, you may want to connect your Continuum Fingerboard to an external Midi synthesizer. To play polyphonically the external synthesizer connected to should be capable of creating channelized voices, that is, Midi voices that are on discrete Midi channels. On some synthesizers this is called Multi-Timbral Mode. A requirement for the Continuum Fingerboard is that this multi-timbral aspect has to extend to any continuous controller that the Continuum is sending out to the synthesizer. Each continuous controller must affect only its own Midi channel, and cannot affect other Midi channels. Each Continuum Fingerboard note contains channelized information in the X, Y, and Z directions, and that includes Midi Note information and continuous controller (Midi cc) information. The chart below shows the output of a Continuum Fingerboard that is set to four voice polyphony, with Y sending out Midi cc74 and Z sending out Midi cc11.

<b>Voice Number</b>	<b>X (left to right)</b>	<b>Y (front to back)</b>	<b>Z (pressure)</b>
<b>1</b>	Midi Note and Pitch Bend on Channel 1	Midi cc74 on Channel 1	Midi cc11 on Channel 1
<b>2</b>	Midi Note and Pitch Bend on Channel 2	Midi cc74 on Channel 2	Midi cc11 on Channel 2
<b>3</b>	Midi Note and Pitch Bend on Channel 3	Midi cc74 on Channel 3	Midi cc11 on Channel 3
<b>4</b>	Midi Note and Pitch Bend on Channel 4	Midi cc74 on Channel 4	Midi cc11 on Channel 4

If the connected external synthesizer is not capable of this kind of discrete channel operation, then it will not work well with the Continuum in a polyphonic sense. However, it is possible that it could be used very well monophonically; see Section 1.9.

When you connect your Continuum Fingerboard to your synthesizer, you will need to configure both the Continuum Fingerboard and the synthesizer.

The easiest way to properly configure an external synthesizer is to follow these two steps:

- (1) Connect your synthesizer through the Continuum Editor, so you can use the Editor and your synthesizer at the same time. Make it work predictably and reliably with a polyphony setting of 1 both on the Continuum Fingerboard and the external synthesizer. Then, once this working well,
- (2) Change polyphony on the synthesizer and the Continuum Fingerboard to match the multi-timbral capabilities of your external synthesizer.

For step one, configure your external synthesizer to respond to Midi channel 1. Set the maximum pitch bend range allowed with an equal value for positive and negative value pitch bends (some synthesizers allow different values for the two directions). Set a matching pitch bend range on your Continuum Fingerboard (as outlined in Section 4.7 of this manual).

Set the Continuum Fingerboard to send a Midi cc value for Z (Section 4.9) to something that will control an amplitude change in the external synthesizer, usually Midi cc11 or Midi cc07.

Set Y (Section 4.8) to a Midi cc value that controls a timbral shift in the synthesizer.

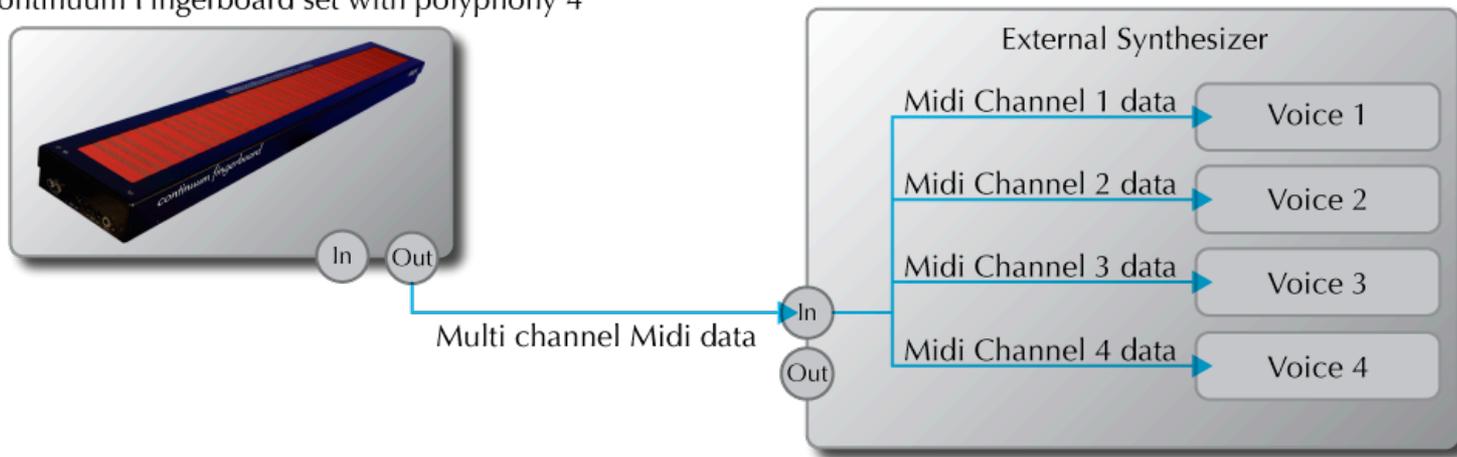
To confirm that pitch bend has been set up correctly, you can do the following test: Play an octave glissando on your Continuum Fingerboard. Then lift your finger, and put it down again at the location where the glissando ended. The pitch you hear should match the ending pitch of the glissando. If it does not, pitch bend ranges are not configured correctly.

Play the synthesizer, and confirm that the sound gets louder and quieter when the surface is pressed harder and softer, and that changes in the Y direction have a desired timbral shift effect. It is a good idea to read through Section 1.12 on further sound design considerations.

Once all of this is working as expected, increase the polyphony of the Continuum Fingerboard, and set a matching polyphony change on the synthesizer. This is where it can get confusing. Polyphony on an external synthesizer usually means number of simultaneous notes on a single Midi channel. Polyphony for a Continuum Fingerboard means number of Midi channels, each channel with a single Midi note, pitch bend and control values for Y and Z. This is a very important concept to understand.

The external synthesizer needs a multi-channel functionality to work correctly, such as the 4 channel example below.

Continuum Fingerboard set with polyphony 4



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## 1.12 Designing Sounds for the Continuum Fingerboard

The Continuum Fingerboard can be used to control a wide variety of sound synthesis algorithms. The predefined built-in sounds, and Preset files prepared by other Continuum players, provide many possibilities. You may also design your own custom sounds in the EaganMatrix or using an external synthesizer. Please consider the following suggestions when selecting or designing sounds to be used with the Continuum Fingerboard.

### The X Direction

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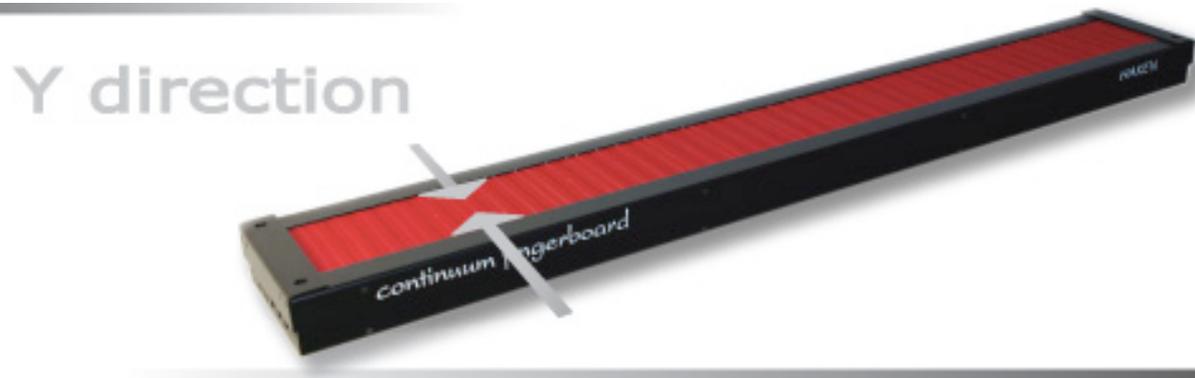


*The X direction of the Continuum Fingerboard is generally mapped to pitch.*

The left to right (X) direction is extremely accurate, and can be used for accurate continuous pitch creation and pitch effects like vibrato and glissandi. Avoid synthesis algorithms with built-in vibrato. A performer's finger movements can create far more expressive pitch and amplitude modulations that produce a much more realistic vibrato than what is programmed into the typical sound synthesis patch.

## The Y Direction

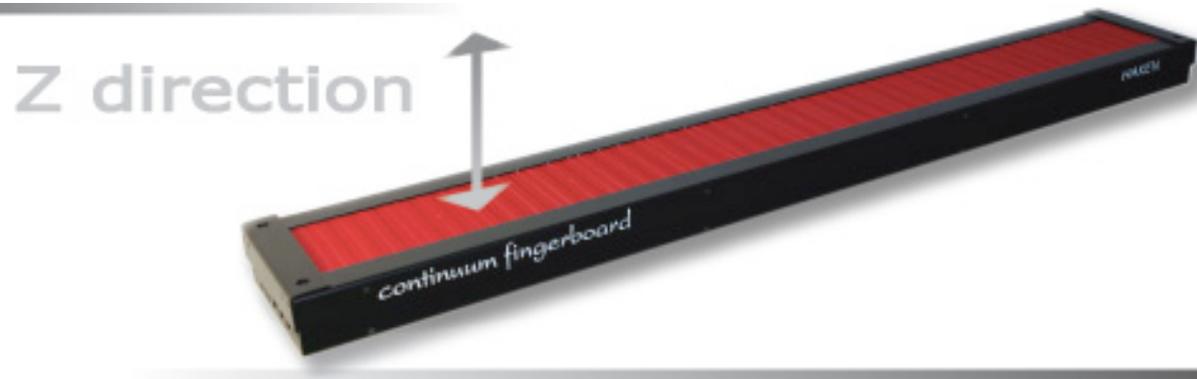
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*The Y direction of the Continuum Fingerboard is generally mapped to a timbre shift.*

Make good use of the front-back (Y) position available from the Continuum Fingerboard. When deciding what parameters to control by front-back position, keep in mind that the Continuum Fingerboard measures front-back position less accurately than pitch or pressure. The front-back position can provide an important expressive tool for the performer when it is used to control appropriate timbre parameters. All the internal sounds in the Continuum Fingerboard utilize Y to some extent. The Eagan Pluck String is a good example of Y usage, as Y is mapped to multiple sound destinations with different control slopes.

## The Z Direction



*The Z direction of the Continuum Fingerboard is generally mapped to a loudness shift.*

Use synthesis algorithms that have timbre changes associated with loudness changes. Some sampling synthesizers change only the volume as the performer's finger pressure changes during a note. This limits the apparent dynamic range and expressive possibilities available to the performer. Most acoustic instruments change their timbre as the volume changes. Keep this in mind as you design your Continuum Fingerboard sounds.

Generally you should use synthesis algorithms that have dynamics controlled by a continuous controller (like expression, volume, or breath). Avoid using Note On key velocity to control dynamics. While the Continuum Fingerboard can be configured to transmit Note On key velocity, it is not usually recommended. Key velocity is a single discrete value that is determined on the note's attack but affects the entire note, unlike a continuous controller which can constantly output a stream of data while a note is sounding. For instance, if you were to use key velocity to affect note volume, you could not start a note quietly and then swell to a loud dynamic during the note's duration. This is the reason the Continuum Fingerboard (like Midi breath controllers) defaults to transmitting a constant 127 for key velocity, and does all dynamic control using channel controllers.

Finally, avoid synthesis algorithms that trigger amplitude envelopes on Note On. An apparent 'double trigger' or 'stutter' effect can result: first you hear the amplitude envelope that is triggered when the finger comes in contact with the playing surface, then you hear a second amplitude increase as the performer's finger pressure increases on the playing surface. In most cases only the performer's finger pressure variations should be controlling the amplitude, not a built-in envelope. However, if you find that the sound uses an amplitude envelope that you like and don't want to discard, consider mapping pressure into another controller that does not affect amplitude.

## 1.13 Quarter Inch Pedal Jacks

Continuum Fingerboards have two quarter inch pedal jack inputs, located on the left end next to the digital interface. These pedal jacks have been tested with Yamaha FC3, FC4, FC5, and FC7 pedals. Many of the parameters to control with pedals are continuous parameters, so the FC3 and FC7 are recommended as they have continuous output values. Using a pedal jack is equivalent to sending the corresponding Midi controller value to the Continuum Fingerboard's Midi In on channel 16. By default, jack 1 corresponds to the Sustain Pedal controller (controller 64) and jack 2 corresponds to Sostenuto Pedal (controller 66). Note that on the Continuum Fingerboard, Sustain and Sostenuto are continuous controls. Section 4.17 describes changing the pedal assignments for the jacks; possible assignments include controlling aspects of the mono function, transposing, internal synthesizer parameters, control voltage generation via the optional Continuum Voltage Converter, and external Midi controller data.

Yamaha Model		Output	Use
FC3		Continuous data values from 0 to 127. This pedal's "dual zone" feature requires additional pressure to reach the highest output values; this feature can be disabled with the pedal's adjustment screw. The pedal's range can be reduced or reversed, using the Continuum Editor's Pedal Min/Max settings. The EganMatrix and CVC read this pedal with high accuracy; Midi accuracy is limited to 7 bits.	As a traditional sustain type pedal action, with the added benefit of a sweepable range from minimum to maximum. Returns to zero when the foot is removed.
FC7		Continuous data values from 0 to 127. This range can be reduced or reversed, using the Continuum Editor's Pedal Min/Max settings. The EganMatrix and CVC read this pedal with high accuracy; Midi accuracy is limited to 7 bits.	A sweepable pedal from 0 to 127, with the ability to stay at a non-zero point when the foot is removed.
FC4		Switch with two values, 0 (off) and 127 (on). Other values for off and on can be selected using the Continuum Editor's Pedal Min/Max settings. (When this pedal is detected by the Continuum Editor, a picture of the FC5 will appear; the FC4 and FC5 are equivalent.)	As a traditional sustain type pedal action limited to switch values. Returns to zero when the foot is removed.
FC5		Switch with two values, 0 (off) and 127 (on). Other values for off and on can be selected using the Continuum Editor's Pedal Min/Max settings.	A compact alternative to the FC4.

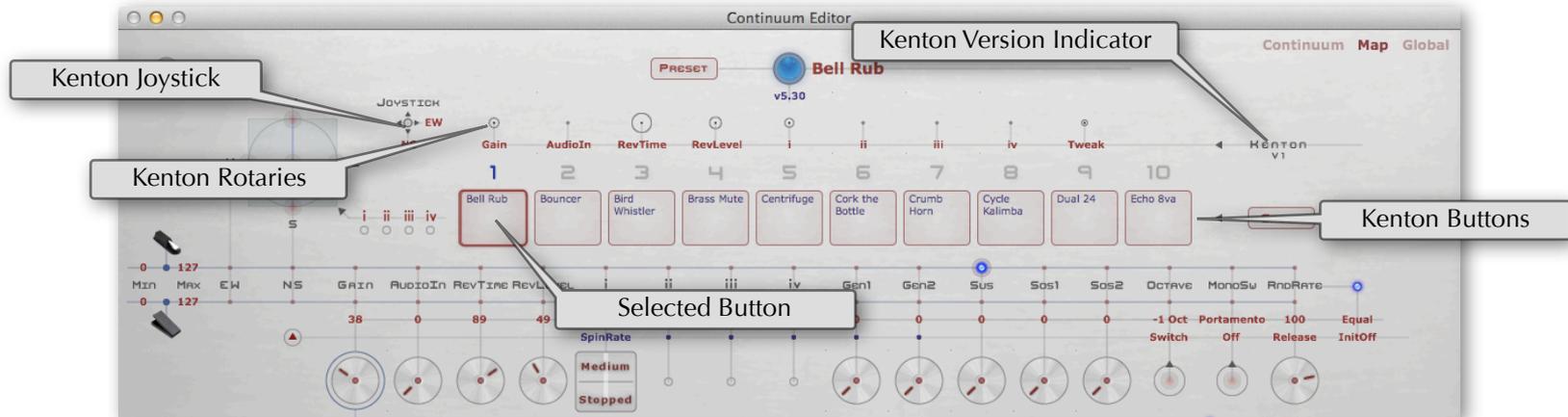
## 1.14 Kenton Mini Controller and Kenton USB Midi Host



*Kenton Mini USB Controller*

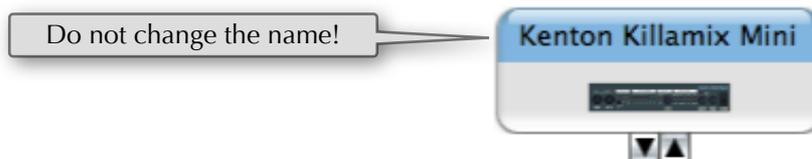
The Kenton Mini Controller seamlessly integrates with the Continuum Fingerboard. The Kenton Mini Controller provides physical buttons for loading presets from the Continuum Fingerboard's Internal User Preset Slots, and the buttons are lit to indicate which preset is loaded. It also provides physical rotaries for configuration parameters and pedal values, allowing precise setting of parameters. Each rotary has a ring of LEDs that indicates its current value.

When the Kenton Mini Controller is used in conjunction with the Continuum Editor, changes made via the Kenton will also be updated on the Continuum Editor's screen, and changes on the Continuum Editor's map page are reflected by the Kenton's LEDs.



*Kenton Mini Controller on the Editor Map page*

Whenever the Kenton Mini Controller is used in conjunction with the Continuum Editor, the Kenton's USB cable must be plugged into the computer **before** launching the Editor. **Mac users:** When the Kenton is connected, do not rename the device called "Kenton Killamix Mini" in the AudioMidi setup program. The Editor uses that name to auto-connect to the Kenton controller. Changing the name will cause a failure in the connection routine.



The Kenton functions are:

Buttons 1..9 load from Internal User Preset Slots 1..9. The button lights indicate which Internal User Preset Slot was most recently loaded.

Rotaries 1 through 9 are assignable on the Continuum Editor's Map page. The rotaries are predefined with default assignments shown below.

<b>Kenton default rotary assignments</b>	
1	Gain level of the internal synthesizer
2	Audio In level of the AES3 digital input
3	Internal Sound reverb time
4	Internal Sound reverb mix
5	Internal Sound Barrel 1
6	Internal Sound Barrel 2
7	Internal Sound Barrel 3
8	Internal Sound Barrel 4
9	Tweak mouseover Editor parameter

Special operations are initiated by pressing the rotaries on the Kenton. Pressing rotary 1 or 2 toggles rotary 1 or 2 respectively to values between 0 and 127. Pressing rotaries 3 or 4 changes which Internal Sound is selected. Pressing rotary 8 loads from Internal User Preset Slot 10. Pressing rotary 9 before a button press will store to an Internal User Preset Slot, rather than load.

In some live performance situations, it is inconvenient to have a computer running the Continuum Editor. The Kenton Midi Controller together with a Kenton USB Midi Host can be used with a Continuum Fingerboard, without the need of a computer. For a live performance situation, the Kenton Mini Controller provides lights that indicate the most recently loaded Internal User Preset Slot, and physical switches for loading presets; this may be preferable over loading presets using the Continuum's Configuration Strip (see Section 4.20).

---

## 2 Calibration

Before you play the Continuum Fingerboard for the first time, and each time you transport it to a new location, you need to go through a simple calibration procedure. The calibration results will be stored in the Continuum Fingerboard's permanent memory, so you will not need to calibrate every time you turn it on.

To calibrate follow this three-step procedure:

- (1) For this first step, make sure your Continuum Fingerboard is powered on, and verify nothing is pressing on the Continuum Fingerboard (no fingers or other objects on the playing surface or frame). Press and release the Red Button (on the left side next to the headphone jack) then touch the surface at the spot labeled "Calibrate" on the Overlay Strip. Release that spot then touch the Surface at the spot labeled "0". Release. The LED will shine bright white to indicate you are calibrating.
- (2) Slowly drag the back of your fingernail (to minimize friction) horizontally across the whole span of the playing surface (from one end all the way to the other), first next to the front edge of the playing surface, then next to the back edge of the playing surface. Do not exert an excessive force; press hard enough to make the surface just begin to "bottom out" at the end of its pressure range. Go back and forth several times, being careful to include the very ends of the surface.
- (3) Next, make sure nothing is pressing on the Continuum Fingerboard (no fingers or other objects on the playing surface or frame), then press and release the Red Button. The LED will now shine dim blue, indicating normal operation.

An additional step 4 may be repeated at any time, without repeating steps 1 through 3 first. We suggest you do step 4 (below) after you have played your Continuum Fingerboard for a few hours, and once a day for the first few days. This is especially important if you are using Light Action (Section 4.18). Doing this calibration step 4 compensates for DC shifts in sensor outputs:

- (4) Make sure nothing is pressing on the Continuum Fingerboard (no fingers or other objects on the playing surface or frame), then press and release the Red Button, touch the surface at "Calibrate," release, then "1," release.

A video showing the calibration procedure is available on the [www.HakenAudio.com](http://www.HakenAudio.com) web site in the Resources area.

### 3 Configuration of the Continuum Fingerboard

The Continuum Fingerboard may be configured by pressing on the playing surface as described in Section 3.1 below. This configuration method is convenient for occasional configuration changes. A better way to configure the Continuum is with the Continuum Editor described in Sections 3.2 and 3.3. You may also use a third party configuration program or pedal board that produces Midi data messages described in Section 7.4.

#### 3.1 Configuring from the Playing Surface using the Overlay Strip

The Continuum Fingerboard's Overlay Strip specifies where to press for each configuration option available from the playing surface.

Calibrate		Internal Sound	Midi Program	CVC	Routing	Polyphony	Channel Priority	X Bend	Y Control	Z Control	Velocity	Middle C	Split Point	Split Mode	Mono Function	Mono Interval	Round Initial	Round Rate	Tuning	Pedal 1	Pedal 2	I	II	III	Options	Send	Load	Save
120+	110+	100+	90+	80+	70+	60+	50+	40+	30+	20+	10+	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

*The Overlay Strip*

The Overlay Strip area is divided so that each option and numeric area matches one semitone of Continuum Fingerboard surface.

Below is a close up of a section of the Overlay Strip:

← Configuration Categories →

Channel Priority	X Bend	Y Control	Z Control	Velocity	Middle C	Split Point	Split Mode	Mono Function	Mono Interval
50+	40+	30+	20+	10+	0	1	2	3	4
<i>Numeric Entry with "+"</i>					<i>Single Numeric Entry</i>				

The configuration categories are along the top of the Overlay Strip. Along the bottom are numeric entry values. The numeric values to the left have a "+" after the number. That denotes they are used in conjunction with the numeric values to the right to create composite value. For instance "30+" and "2" makes the number "32".

The Continuum Fingerboard's configuration is changed by using this Overlay Strip and following these general directions:

<b>Start</b>	The color of the LED is dim blue during normal operation.	
<b>Red Button</b>	Press and release the Red Button next to the Headphone output on the side of the Continuum Fingerboard. The LED will turn from dim blue to bright red.	
<b>Configuration Category</b>	Touch the far edge of the Continuum Fingerboard surface at a matching point to a configuration category. The LED will shine a brighter green while your finger is touching the surface, and return to a darker green after the touch.	
<b>Numeric Entry</b>	Touch the far edge of the Continuum Fingerboard surface at a matching point to a numeric value. Touching a numeric with a plus after the numeral means the Continuum Fingerboard is waiting for a second numeric touch. For instance, touching "80+" then "4" is equivalent to a numeric value of 84. The LED will shine a brighter green while your finger is touching the surface. The LED will return to a darker green when it is waiting for the second half of a dual numeric touch.	<p><b>single</b></p>  <p><b>or dual</b></p> 
<b>Configuration Changed</b>	After the single numeric touch or the dual numeric touch the LED will go back to dim blue. The configuration has been changed.	

## 3.2 Configuring using the Continuum Editor

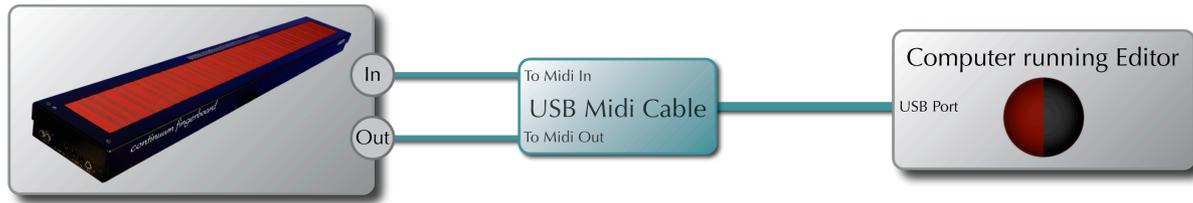


*The Continuum Editor*

The Continuum Editor is an application designed by Edmund Eagan, available for both Mac and PC from the Haken Audio website. All interaction with the Continuum Editor comes from one expandable interface window with three pages named “Continuum”, “Map”, and “Global”. In addition to replicating the functionality of the Overlay Strip, the Editor can also be used to save Presets and open them later from your computer (Section 4.21), and to load new firmware into the Continuum Fingerboard (Section 5). The Editor requires a bidirectional Midi communication to work with the Continuum Fingerboard.

### **IMPORTANT:**

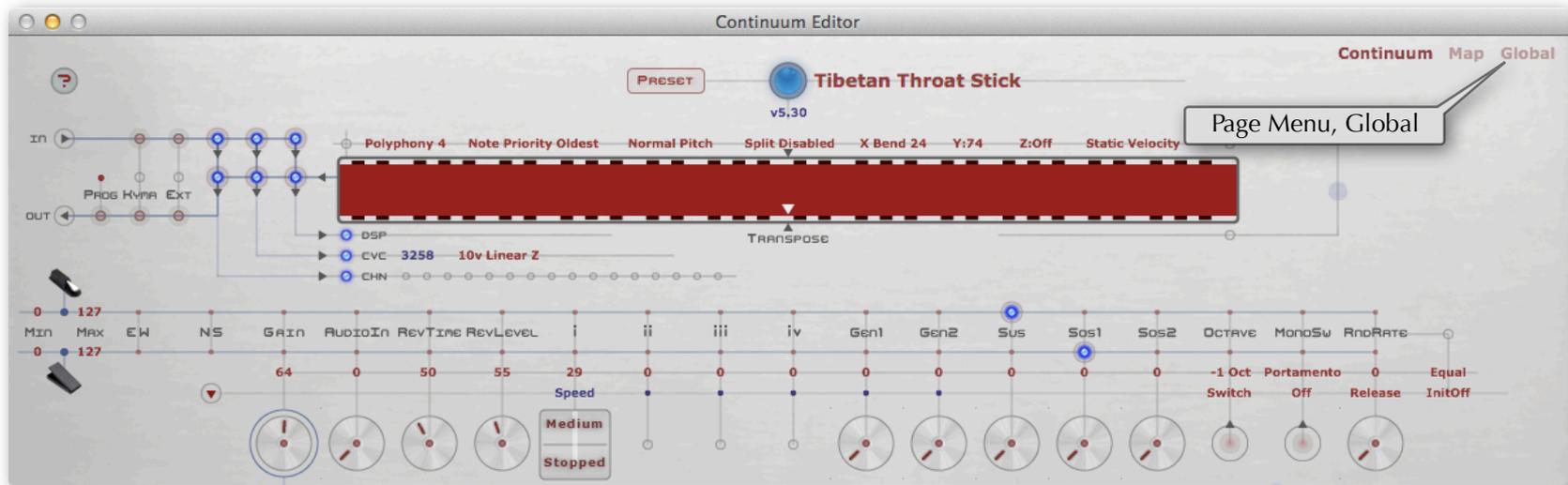
Keep the Editor application in the “Continuum Editor” folder as supplied by Haken Audio. The Editor refers to other folders in this Continuum Editor folder.



Simple Midi cabling for the Continuum Editor. This bidirectional communication setup allows the Continuum Fingerboard to interact with the Editor through a standard USB to Midi interface.

### 3.3 Setting up the Continuum Editor

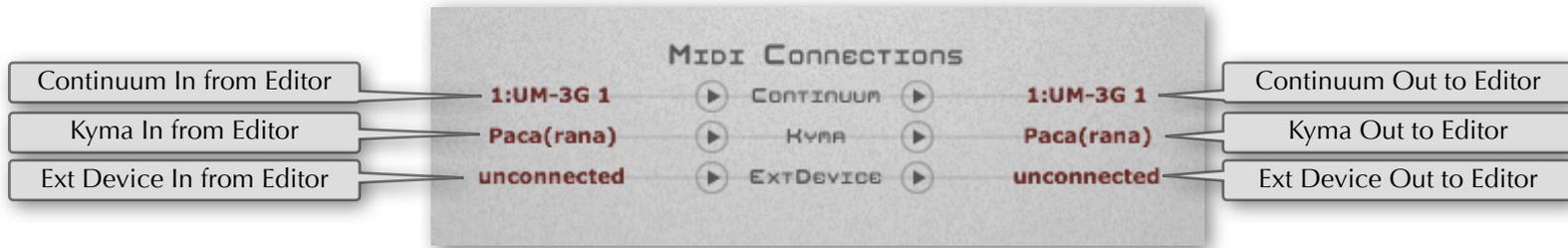
When first running the Continuum Editor, make sure that you have the before-mentioned bidirectional Midi connection set up correctly. The Continuum Editor will not function at all if this is not set up properly. Turn on your Continuum Fingerboard (if it isn't already), launch the Continuum Editor, and wait for the Editor to appear on the screen (takes about 15 seconds). At first launch, the Midi routing in the Editor is unconnected. To establish this connection, go to the Global page of the Editor, by clicking on the word Global in the Page menu as shown below.





Global page in the Continuum Editor.

The Midi Connections area has three pairs of popup menus which allow the routing of Midi data, as described below.



**The “Continuum” connections: Connections to/from the Continuum Fingerboard.**

Once the input and output connections for the Continuum Fingerboard are correctly made, the LED at the top-center of the Editor will change to from “off” to “blue”.

### **The “Kyma” connections: Connection between the Continuum Fingerboard and Symbolic Sound’s Paca(rana) hardware via the Editor.**

If you are running Symbolic Sound Paca(rana) hardware, you can connect to it via Midi or (even better) connect to it using Delora’s KymaConnect software. A bidirectional connection between the Paca(rana) and the Continuum is necessary in order for Kyma to communicate information about its currently playing sound to the Continuum Fingerboard. Set to “unconnected” if no Kyma Paca(rana) system is present.

### **The “ExtDevice” connections: Connections between the Continuum Fingerboard and an External Midi Device via the Editor.**

The “ExtDevice” connections create a bidirectional communication with a hardware or software synthesizer and the Continuum Fingerboard through the Continuum Editor. If you don’t need the Continuum Editor to route to an external synthesizer set the “ExtDevice” setting to “unconnected.”

### **Remembering the Midi Setup connection in the Continuum Editor:**

When the Editor is closed the Midi connections are automatically remembered. When the Editor is reopened it will try to establish connections with the same named Midi ports. Midi devices should be turned on and connected before starting the Editor.

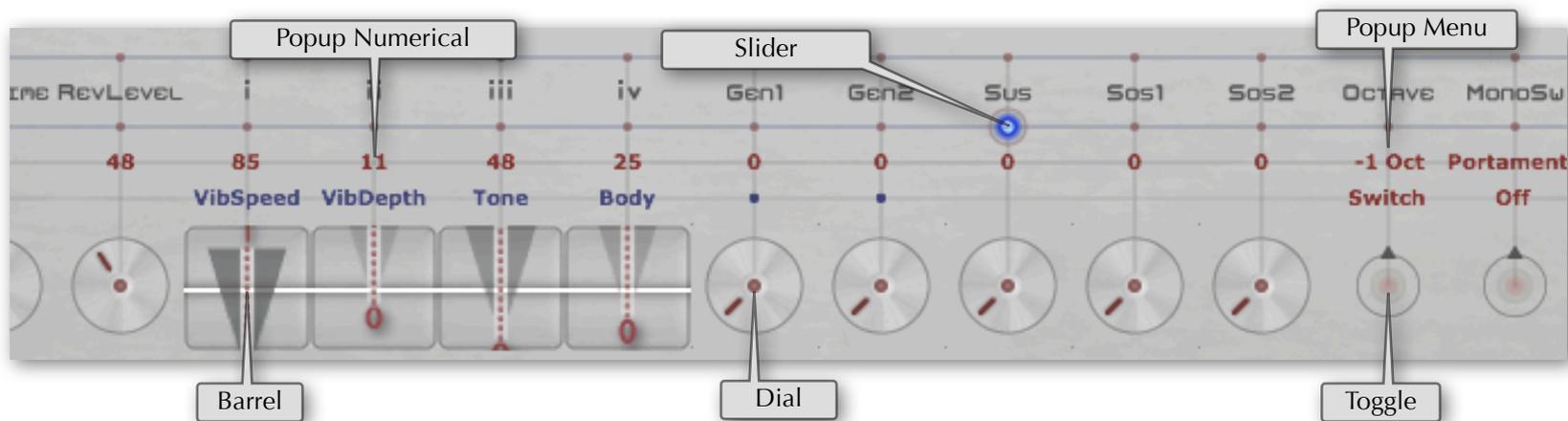
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## 3.4 Using the Continuum Editor

The Continuum Editor has three pages: Continuum, Map, and Global. Switch pages by selecting from the Page menu at the top right.

<b>Continuum Editor pages</b>	
Continuum	General parameters relating to the Continuum surface and performance options, including data routing.
Map	Internal User Preset Slots, Kenton Mini Controller, and NSEW.
Global	Parameters which affect the Continuum Fingerboard as a whole, as well as the ability to load new firmware.

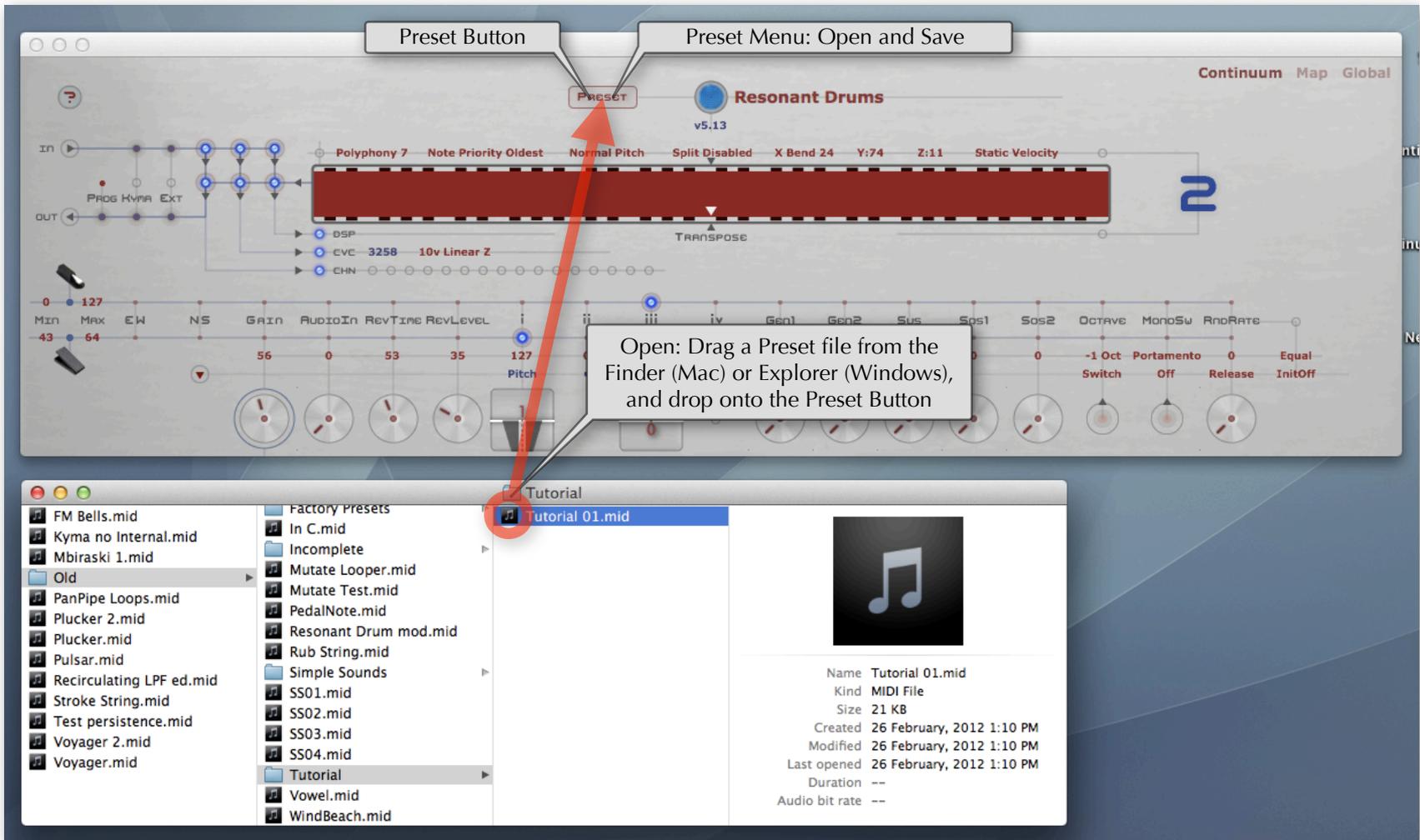
The control types in the Continuum Editor are popup menus, dials, toggles, barrels, and sliders.



<b>Barrel</b>	Click and drag mouse vertically to desired value. Numerical value above each barrel will update as well.
<b>Popup Numerical</b>	Click once to activate popup, click on the desired value to make a selection.
<b>Slider</b>	Click and drag indicator to desired value.
<b>Dial</b>	Click and drag mouse vertically to desired value.
<b>Popup Menu</b>	Click once to activate popup, click on the desired value to make a selection.
<b>Toggle</b>	Click to toggle value. Red around the toggle means "on", no red ring means "off".

The Continuum Editor gets the current configuration from the Continuum Fingerboard's internal memory. When the Continuum Editor is running, changes made via the Overlay Strip or the Kenton Mini Controller will also be updated on the Continuum Editor's screen.

### 3.5 Open and Saving Presets in the Editor



Choosing Save from the Continuum Editor's Preset popup menu, or pressing Command+S (Control+S Windows), creates a Preset file on your Mac or PC. The name you choose for the file will be the name of the preset, and the contents of the file will be the current configuration on your Continuum Fingerboard. You can Open this Preset file at a later time using Open in the Preset popup menu, or Command+O, or by dragging the file from the Finder (Mac) or Explorer (Windows) onto the Editor's Preset popup menu area.

The Continuum Editor can be used to edit and save presets in a studio setting where a computer is available. In addition to Preset files on your Mac or PC, you can also use the Editor to store presets into the Continuum’s Internal User Preset Slots; you can load presets from the Internal User Preset Slots using the Overlay Strip (or using a Kenton Mini Controller with Kenton USB Host, see Section 1.14) in a live situation where a computer is not available.

### 3.6 Continuum Editor Shortcuts

<b>Editor Shortcuts</b>	
Open Preset File	Command+O (Control+O Windows), or drag a file from the Finder (Mac) or Explorer (Windows) and drop it onto the Editor’s Preset popup menu area
Save Preset File	Command+S
Load from Internal User Preset Slot	Command+1..9 loads from Internal User Preset Slot 1..9, Command+0 loads 10
Store to Internal User Preset Slot	Shift+1..9 stores current configuration to Internal User Preset Slot 1..9, Shift+0 stores to Internal User Preset Slot 10, or drag a Preset file from the Finder (Mac) or Explorer (Windows) and drop it onto one of the 10 Internal User Preset Slot areas on the Map page
Open Preset Group File	Drag a Preset Group file onto the Group popup menu on the Map Page
Next Page / Previous Page	Down Arrow / Up Arrow
Increase / Decrease Mouseover Editor Value	Right Arrow / Left Arrow
Large Editor Window	Command+L toggles visibility of Description and EaganMatrix
To modify the selected point in the EaganMatrix	Type a..o for user-defined formulas A..O, w..z for predefined formulas W..Z, 1..9 for constant values 1..9, .01 .. .99 type decimal point then two digits for constants .01 .. .99, press Delete to remove the matrix point (disconnect row from column)
To move the selected point in the EaganMatrix	Drag to a new matrix location (Alt-Drag to copy)
To deselect point in EaganMatrix and show Description	Escape

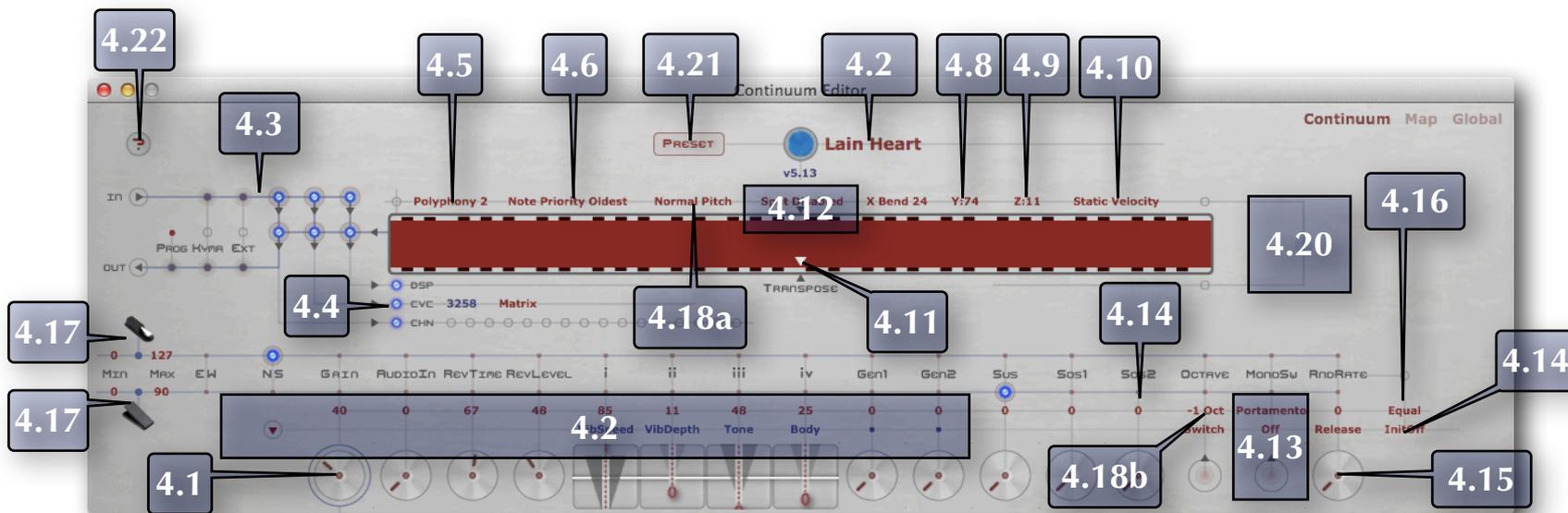
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## 4 Configuration Options from the Overlay Strip and the Continuum Editor

Sections 4.1 to 4.22 describe configuration options available for the Continuum Fingerboard. The descriptions apply both to configuration from the Continuum Fingerboard's playing surface using the Overlay Strip, and the Continuum Editor. The order of option descriptions is based on the order of options on the Overlay Strip. Each configuration option uses a table with this layout:

<b>Category Name (as it appears on the Overlay Strip)</b> <i>This is the first surface touch when you configure using the Overlay Strip.</i>	
<p>Numeric Value(s) on the Overlay Strip <i>This is the second and possibly the third surface touch when you use the Overlay Strip.</i></p>	<p>In here will be the explanation as to what this Category-Numeric value combination means.</p>
	<p>Functionality specific to the Continuum Editor. Almost all the functionality of the Overlay Strip is replicated in the Continuum Editor.</p>

The legend below is labeled with numbers tying the Continuum page of the Continuum Editor to the appropriate User Guide section. Refer back to this legend for most references throughout Section 4. References to other pages of the Continuum Editor are placed in line.



The Continuum Page of the Continuum Editor.

The white overlay numbers in this diagram refer to numbered sections within this User Guide.

## 4.1 Gain 🎧

🎧	
0	Gain level off.
1 to 127	Level of the output from soft to loud. Excessively high gain may clip at high polyphony.
🎛️	Tip: Use low Gain values, together with high L and R values in the matrix, to introduce a soft saturation in the EaganMatrix.

## 4.2 Internal Sound

The Continuum Fingerboard's built-in synthesizer has a number of system presets available. The first 18 system presets are specialty algorithms, and the remaining system presets are implemented using the user-programmable EganMatrix synthesizer (refer to the EganMatrix User's Guide for more information).

The Internal Sound presets can be modified by setting configuration values for i, ii, iii, iv, and Gen 1 in the Continuum Editor, or via the Overlay Strip, or by pedal, or using the Kenton Mini Controller. Gen 1 is available on some sounds as a release parameter, allowing a sound to decay after a finger is released from the Continuum Fingerboard playing surface.

<b>Internal Sound Number and Name</b>	
<b>Polyphony</b>	General description.
<b>i</b>	Description for the "i" control.
<b>ii</b>	Description for the "ii" control.
<b>iii</b>	Description for the "iii" control.
<b>iv</b>	Description for the "iv" control.
<b>Gen1</b>	Description for the "Gen1" control (typically Release).

<b>Internal Sound #0: FM Synthesis 1</b>	
<b>32</b>	A single oscillator that is frequency modulated by another oscillator. The modulation amount will increase as Y increases. As well, starting a note at a greater than 50% Y value will further increase the modulation amount for that note.
<b>i, ii, iii, iv, Gen1</b>	Not assigned.

<b>Internal Sound #1: FM Synthesis 2</b>	
<b>32</b>	A single oscillator that is frequency modulated by another oscillator. The modulation amount will increase as Y increases. As well, starting a note at a greater than 50% Y value will further increase the modulation amount for that note. This sound has an alternate modulation amount compared to FM 1. Live controls include a variable attack envelope and modulator frequencies.
<b>i</b>	Attack: Amount of an attack envelope applied. Envelope depth increases depending on an initial reading of the Z value of a note.
<b>ii</b>	Freq: The pitch of the modulating oscillator.
<b>iii</b>	Y Freq: The amount in which Y influences the pitch of the modulating oscillator. Higher values of Y will increase the pitch.
<b>iv, Gen1</b>	Not assigned.

<b>Internal Sound #2: Four Point FM</b>	
<b>32</b>	A single oscillator that is frequency modulated by four other oscillators. The modulation will vary with Y and Z, according to barrels i, ii, iii, and iv.
<b>i</b>	Modulation index and modulation frequency for Y=0,Z=0.
<b>ii</b>	Modulation index and modulation frequency for Y=0,Z=1.
<b>iii</b>	Modulation index and modulation frequency for Y=1,Z=0.
<b>iv</b>	Modulation index and modulation frequency for Y=1,Z=1.
<b>Gen1</b>	Not assigned.

<b>Internal Sound #3: PluckString</b>	
<b>8</b>	A physically modeled string. In general, the sound is brighter and more sustained when Y is closer to maximum, and muted and plucked when Y is closer to minimum. As well, there is a multipluck envelope that occurs when a note is held down, stronger and faster when Y approaches minimum. Fast releases from the surface will amplify a release pluck envelope.
<b>i</b>	Body: A resonant body varying from metallic, to wooden, to synthetic through which the string sounds.
<b>ii</b>	Multipluck: The maximum level of the multipluck envelope when Y is closer to zero.
<b>iii</b>	RelPluck: The maximum level of the release pluck attack when a finger is lifted from the playing surface. Faster releases will result in a louder release pluck.
<b>iv</b>	Not assigned.
<b>Gen1</b>	Release: Decay time of a release envelope.

<b>Internal Sound #4: Feedback String</b>	
<b>8</b>	A physically modeled plucked string. The longer this sound is sustained with high Z (pressure) values, the more the sound with feedback at one of three particular harmonics. The harmonic that is predominantly sustaining depends of the position of Y.
<b>i</b>	Body: A resonant body through which the string sounds. This body can continuously blend between wood to metal, metal to fiber, and fiber to wood.
<b>ii</b>	Mute: Higher values will result in a more muted (faster decaying upper harmonics) sound.
<b>iii, iv</b>	Not assigned.
<b>Gen1</b>	Release: Decay time of a release envelope.

<b>Internal Sound #5: Mouth String</b>	
<b>8</b>	A physically modeled plucked string through a vocal formant filter. Y position determines vocal formant. Fast releases from the surface will amplify a release pluck envelope.
<b>i</b>	Not assigned.
<b>ii</b>	Mute: Higher values will result in a more muted (faster decaying upper harmonics) sound.
<b>iii, iv</b>	Not assigned.
<b>Gen1</b>	Release: Decay time of a release envelope.

<b>Internal Sound #6: Rosin Oscillator</b>	
<b>8</b>	A hybrid synthesis utilizing a summation oscillator and a modal filter.
<b>i</b>	Body: A resonant body for the output of the sound. This body can continuously blend between wood to metal, metal to fiber, and fiber to wood.
<b>ii,iii,iv, Gen1</b>	Not assigned.

<b>Internal Sound #7: Wind</b>	
<b>32</b>	A physically modeled wind pipe. The sound is rounder with less air noise when Y is closer to minimum. As Y increases, more air is added and the sound becomes more present. At high values of Y, even more air is added and the sound has a tendency to “octave break”, much like the overblowing sound of a real wind instrument.
<b>i</b>	Body: A resonant body through which the wind timbre sounds. This body can continuously blend between wood to metal, metal to fiber, and fiber to wood.
<b>ii</b>	Harmonic: Energy distribution between odd and even harmonics. The even distribution includes the fundamental frequency.
<b>iii</b>	Air: Amount of blowing or wind noise.
<b>iv</b>	Feedback: The level of feedback within the tone generation loop.
<b>Gen1</b>	Not assigned.

<b>Internal Sound #8: Slide Wind</b>	
<b>32</b>	A physically modeled wind pipe. As Y increases, there is a pitch shift in the harmonics, resulting in a unique timbre shift, sounding unlike any acoustic instrument, but with interesting musical appeal.
<b>i</b>	Body: A resonant body through which the wind timbre sounds. This body can continuously blend between wood to metal, metal to fiber, and fiber to wood.
<b>ii</b>	Slide Start: The starting amount of the harmonic shift.
<b>iii</b>	Air: Amount of blowing or wind noise.
<b>iv</b>	Slide Depth: The amount of harmonic shift as Y approaches maximum.
<b>Gen1</b>	Not assigned.

<b>Internal Sound #9: Metal Bar</b>	
<b>32</b>	A physically modeled struck metal bar. Fluctuations in Z will cause the bar to continuously re-attack. The sound will be more damped when are started with higher Y values.
<b>i</b>	Damping: Higher values will cause more damping (faster decay of upper harmonics and amplitude in general).
<b>ii</b>	Dynamics: Determines loudness dependence on Z.
<b>iii, iv</b>	Not assigned.
<b>Gen1</b>	Release: Decay time of a release envelope.

<b>Internal Sound #10: Timbre Morph</b>	
<b>16</b>	A timbre player that uses a minimum of source sample material to create formant and pitch shifted sounds.
<b>i</b>	Timbre source selection when Y = 0. The timbre sources are a selection of samples that are subsequently pitch and formant modified. The barrel control allows for a blend of adjacent samples. As Y changes from 0 to 1, less of the timbre blend selected by barrel i and more of the timbre blend selected in barrel ii will be heard.
<b>ii</b>	Timbre source selection when Y = 1.
<b>iii</b>	Size: The body size (or formant shift), from large (dark and more mellow) to small (brighter and more nasal).
<b>iv</b>	Z Body: The influence of Z (finger pressure) in changing the body size.
<b>Gen1</b>	Release: Decay time of a release envelope.

### Internal Sound #11: Clinical Oscillator 1

<b>6</b>	An oscillator with an adjustable harmonic content. As Y increases, the energy of the even harmonics decreases. The idea here is to supply a stable raw oscillator source that can then be externally modified, such as through subtractive synthesis in an analog modular system.
<b>i</b>	Brightness: Amount of upper harmonic content.
<b>ii</b>	ZBright: Additional brightness with increased Z (finger pressure)
<b>iii</b>	Delay: A mixture between a dry oscillator and two time delayed oscillators.
<b>iv</b>	Delay Time: Time amount for the time delayed oscillators.
<b>Gen1</b>	Release: Decay time of a release envelope.

### Internal Sound #12: Clinical Oscillator 2

<b>6</b>	An oscillator with an adjustable harmonic content. As Y increases, the energy of the even harmonics decreases. The idea here is to supply a stable raw oscillator source that can then be externally modified, such as through subtractive synthesis in an analog modular system.
<b>i</b>	Brightness: Amount of upper harmonic content.
<b>ii</b>	ZBright: Additional brightness with increased Z (finger pressure)
<b>iii</b>	Harmonics: A brick filter that gradually mutes harmonic content.
<b>iv</b>	Detune: Pitch deviation of the unison oscillators.
<b>Gen1</b>	Release: Decay time of a release envelope.

### Internal Sound #13: Tuned Reverb

<b>8</b>	A reverb that will process the external stereo audio at the Continuum Fingerboard's AES3 input, with resonant filters that are controlled by fingers on the playing surface.
<b>i</b>	Audio: Scale factor for the AES3 input.
<b>ii</b>	Impulse: Level of a noisy impulse generated whenever a finger first touches the surface.
<b>iii</b>	Dry: Level for input unprocessed by reverb.
<b>iv</b>	Filters: Brightness control for filters.
<b>Gen1</b>	Bypass: Level for output unprocessed by tuned filters.

<b>Internal Sound #14: Pitch Formant Shifter</b>	
<b>12</b>	A polyphonic pitch shifter that will process the external stereo audio at the Continuum Fingerboard's AES3 input, creating polyphonic pitch and formant shifted voices. For best results the input should be a single pitch line without reverberation, chorusing, or doubling.
<b>i</b>	Hi Pitch: The input must be in the pitch detection window, from Hi Pitch value to one octave below.
<b>ii</b>	Size: The body size (or formant shift), from large (dark and more mellow) to small (brighter and more nasal).
<b>iii</b>	Y Size: The influence of Y (front/back) on the body size. As Y increases body size decreases.
<b>iv</b>	Z Size: The influence of Z (finger pressure) in changing the body size.
<b>Gen1</b>	Release: Decay time of a release envelope.

<b>Internal Sound #15: Additive 1</b>	
<b>3</b>	Additive sine synthesis of Dr. Andreas Mahling speaking a phrase. Y controls the speed.
<b>i</b>	LowPartial: Lowest partial (sine wave) to synthesize (usually 0).
<b>ii</b>	HiPartial: Highest partial (usually 127).
<b>iii, iv, Gen1</b>	Not assigned.

<b>Internal Sound #16: Additive 2</b>	
<b>3</b>	Additive sine synthesis of Dr. Andreas Mahling speaking a phrase. Y controls formants, Z controls the speed.
<b>i</b>	LowPartial: Lowest partial to synthesize (usually 0).
<b>ii</b>	HiPartial: Highest partial (usually 127).
<b>iii, iv, Gen1</b>	Not assigned.

<b>Internal Sound #17: Additive 3</b>	
<b>3</b>	Additive sine synthesis of Dr. Andreas Mahling, X is a scrub through the phrase, Y is a slight pitch control.
<b>i</b>	LowPartial: Lowest partial to synthesize (usually 0).
<b>ii</b>	HiPartial: Highest partial (usually 127).
<b>iii, iv, Gen1</b>	Not assigned.

### Internal Sound: EaganMatrix System Presets

Internal sounds above #17 are predesigned sounds implemented with the EaganMatrix. They are playable as sounds on their own, or can be user-edited. More EaganMatrix Presets are available in the Archives folder inside your Continuum Editor folder, and from other Continuum Fingerboard players that share EaganMatrix Presets they design. For information on designing your own Presets, refer to the EaganMatrix User's Guide.

---

## 4.3 Midi Program, Midi Routing, Kyma, ExtDevice

### Midi Program:

The Continuum Fingerboard will send a Midi Program Change message on all active Midi channels through its Midi output. The Program Change is sent immediately when you configure it, and each time the preset is loaded (see Section 4.20).

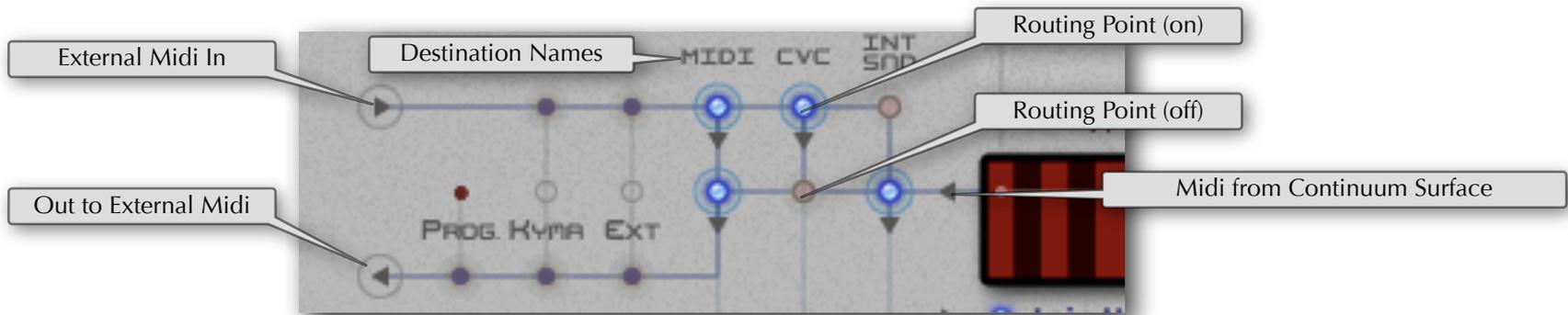
Midi Program	
0 to 126	Sends the numeric Midi Program message on all active Midi channels.
127	The Continuum Fingerboard external Midi Program feature is disabled.

### Midi Routing:

By default, the Continuum Fingerboard merges Midi messages from the Midi In jack to all of the following: Midi Out jack, CVC (Continuum Voltage Converter), and the built-in synthesizer. The Midi In messages are merged with the Midi messages that track fingers on the playing surface. Caution: If you supply Midi notes to the Midi In jack, you will want to avoid having notes from both the playing surface and the Midi In using the same Midi channel; the merged Midi messages will interfere with each other.

These are the values for the Routing configuration option:

Routing	
0	Disable merging data from the Midi In jack.
1	Midi In data is merged with playing surface data and goes to Midi Out.
2	Disconnects the playing surface from the Internal Sound.
3	Disconnects the playing surface from the CVC.
	More options are available by using the Continuum Editor program, which uses a routing matrix for every assignable input and output, as explained below.

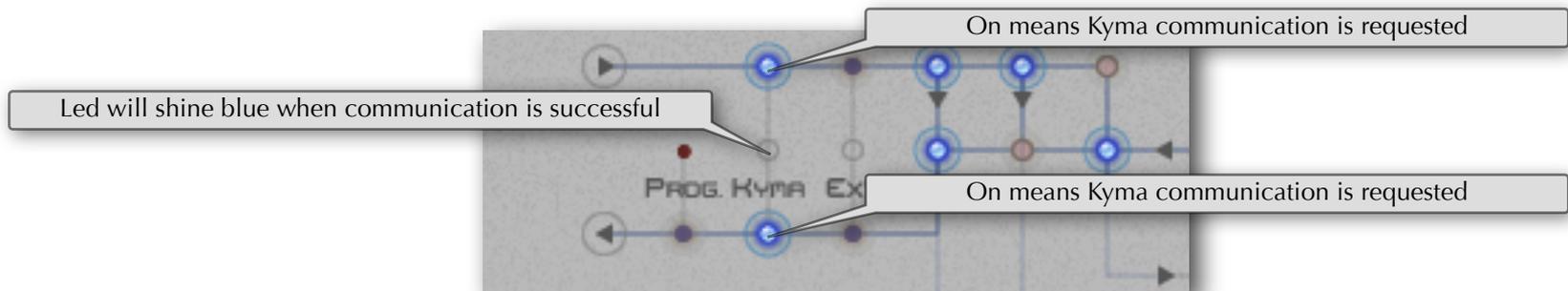


The Routing section of the Continuum Editor.

Continuum Editor Routing Icons	
Led On (Blue)	Data passes from the source to the destination below.
Led Off	Data is blocked from the source to the destination below.

**Kyma Communication:**

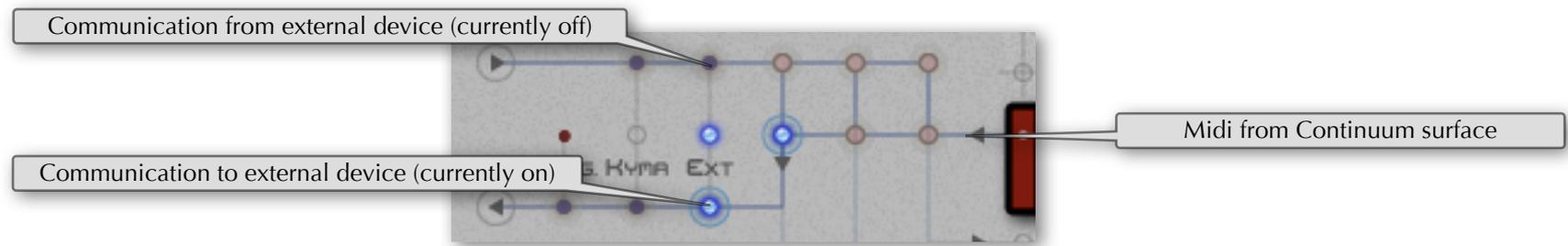
Kyma routing via the Overlay strip is explained in option 10 of Section 4.18. In the Continuum Editor, initiating Kyma communication is done to the left of the Routing area. Make sure that Kyma is running and that the proper Midi communication is established between the Continuum Fingerboard, Kyma, and the Continuum Editor. For more information, refer to the setup explanation in Section 3.2, and the Additional Text for option 10 of Section 4.18.



When communication is requested Kyma will communicate back, and the Led will light up blue. Kyma will now automatically update the Continuum Fingerboard when sounds are loaded and changed inside Kyma. Kyma-controlled Continuum Fingerboard parameters are: Polyphony, XBend, Y Controller, Z Controller, and Midi Note Velocity. Kyma also imposes its own split parameters, which are not reflected in the Continuum Editor. All affected Kyma parameters will have blue text in the Continuum Editor.

### External Device Routing:

The Continuum Editor can be used to route Midi to another external Midi device (an external hardware synth, or a software synth external to the Continuum Editor), allowing the Midi connection to/from the Continuum to be used both for the Editor and this external device.



In the example above the only enabled Midi routing is FROM the Continuum surface TO the external device.

---

## 4.4 CVC

Select standard voltage ranges for the Continuum Voltage Converter (CVC), as described in the CVC User Guide (available in the Resources area of [www.HakenAudio.com](http://www.HakenAudio.com)). This option has no effect if there is no CVC connected, or if an EaganMatrix preset is active and the matrix's CVC section specifies control voltages.

---

## 4.5 Polyphony

<b>Polyphony</b>	
1 to 16	Maximum number of simultaneous output notes (default is 8). When polyphony is set to 16, Internal Sounds will play at their maximum polyphony, which can be as high as 32.

---

## 4.6 Channel Priority

Fingers on the playing surface will generate output for Midi channels depending on the Polyphony and Split configuration. The order in which the new notes from the playing surface are assigned to Midi channels can be LRU (assign the new note to the Least Recently Used channel) or LVN (assign to the Lowest Voice Number that is available). The default is LRU. The High 1 through High 4 settings are useful in directing which Midi channels or being currently used by the Continuum. This could be useful in a situation where one wishes to overdub Midi performances and avoid channel reuse for each record pass.

<b>Channel Priority</b>		
0	LRU	Least Recently Used
1	LVN	Lowest Voice (Midi channel) Number
2	High 1	Only highest channel of current polyphony is used.
3	High 2	Only highest two channels of current polyphony is used.
4	High 3	Only highest three channels of current polyphony is used.
5	High 4	Only highest four channels of current polyphony is used.

### High 1 through High 4

To do a Midi overdub recording with the High 1-4 settings, decide on the number of voices for each overdub pass. For instance, if the sound used for playing has a polyphony of 8 and it is desired to have two voices available for each overdub pass, then:

1. For the first pass set Channel priority to High 2 and Polyphony to 2. The first pass (the initial recording) is recorded onto Midi channels 1 and 2.

2. For the second pass leave Channel priority to High 2 and set Polyphony to 4. The second pass is recorded onto Midi channels 3 and 4, while the first pass can be heard on Midi channels 1 and 2.
3. For the third pass leave Channel priority to High 2 and set Polyphony to 6. The third pass is recorded onto Midi channels 5 and 6, and the first two passes are heard on channels 1 through 4.
4. For the final pass leave Channel priority to High 2 and set Polyphony to 8. The fourth pass is recorded onto Midi channels 7 and 8, and the other three passes are heard on channels 1 through 6.

### An Important Caveat!

Midi-based multitrack recording like this may or may not compromise the Midi bandwidth. The Continuum Fingerboard's Midi bandwidth is highly optimized in relation to the current polyphony of a Continuum performance. Recording and overdubbing Midi in this fashion described above may overflow the Continuum's Midi stream, since the Continuum doesn't "know" the overall polyphony from the combination of surface and Midi In activity, but can only make data streaming adjustments according to polyphony from the playing surface.

## 4.7 X Bend

X Bend is the Midi pitch bend range that the Continuum Fingerboard uses to encode its Midi output. Set X Bend to match the Midi pitch bend range you set on your external synthesizer. You should select the largest bend available on your synthesizer, so that you can play the longest possible glissandi. The pitch bend range of 96 allows you to glissando over the complete pitch range of the full-size Continuum Fingerboard. Since Pitch Bend is encoded in 14 bits, it provides 1/100<sup>th</sup> half-step (1 cent) encoding accuracy at a 96 half-step range. In some rare synthesis situations 1 cent accuracy is not adequate; for these situations the Continuum Fingerboard can transmit pitch accuracy beyond 1 cent using a custom 21-bit bend encoding; please see Section 4.18 for details.

X Bend	
1 to 96	Midi Pitch Bend range as expressed in half steps (default is 24).
	The Continuum Editor has a reduced selection set comprised of the most useful values.

**When using an external synthesizer, it is important to verify proper Pitch Bend Range configuration:** Play a glissando; when you lift your finger at the end of the glissando, play a new note at the spot where you lifted your finger. The pitch at the end of the glissando should match the new note's pitch; if not, the Pitch Bend Range configured on your Continuum Fingerboard does not correctly match your synthesizer.

---

## 4.8 Y Control

The continuous controller number that Y (front to back position) sends through the Midi output. The most common choices are: 1 for “modulation”, 2 for “breath”, or 74 for “brightness” (the default). In some synthesis situations 7-bit accuracy is not adequate for the Y position; for these situations the Continuum Fingerboard can transmit pressure accuracy beyond 7 bits using a custom 14-bit synchronous Midi encoding. Please see Section 4.18 for details

<b>Y Control</b>	
0	Off (no controller information sent).
1-4, 7,11,74	Continuous controller number generated by the Y position (default is 74).
127	Transmit Y value using controller 74, without shelving values at both ends of the y range.

---

## 4.9 Z Control

The continuous controller number that Z (finger pressure) sends through the Midi output. The most common choices are: 7 for “channel volume” or 11 for “expression” (the default). In some synthesis situations 7-bit accuracy is not adequate for finger pressure; for these situations the Continuum Fingerboard can transmit pressure accuracy beyond 7 bits using a custom 14-bit synchronous Midi encoding. Please see Section 4.18 for details.

<b>Z Control</b>	
0	Off (no controller information sent).
1-4, 7,11,74	Continuous controller number generated by the Z position (default is 11).

---

## 4.10 Midi Note Velocity

Midi note velocity can either be static (always at 127) or dynamic (a value generated by calculating finger velocity when the surface is touched). The static setting is usually preferable and is the default.

<b>Velocity</b>	
0	Static: Midi key velocity is always 127.
1	Dynamic: Midi key velocity depends on initial finger velocity.
2	No Note Output: The Continuum does not output Midi Note and Pitch Bend information.
3	External Note Mode: The Continuum acts as a 3-d ribbon controller, providing pitch bends for an external Midi keyboard. Often this is used in conjunction with Z Control set to 0 (Section 4.9), so that no pressure information is in the Continuum's Midi output.

---

## 4.11 Middle C

You may select a transposition of the playing surface in half-step increments by specifying a midi note number for the Middle C position.

<b>Middle C</b>	
0 to 127	The specified midi note number is the new pitch for the "Middle C" position. For instance, a value 60 is no transposition, value 48 transposes down one octave, and a value of 72 transposes up one octave.

---

## 4.12 Split Point and Split Mode

You may select a playing surface split point. For the split point to be effective you must also select a split mode. The split mode together with your polyphony configuration determines how many simultaneous notes you can play above and below the split point.

<b>Split Point</b>	
Surface position	Division point for the split. For instance, touching the surface at Middle C will create a split point at Middle C.

Split Mode		Notes
0	Split is deactivated.	
1	Split into two polyphonic ranges. All pitches below the split point will be encoded on the first half of your Midi channels, and pitches above the split point will be encoded with the remaining Midi channels.	Split modes 1-3 treat Midi, CVC, and internal sounds all the same. See note after this table.
2	Split into a monophonic low range and polyphonic high range. All pitches below the split point will be encoded on Midi channel 1, and the pitches above the split point will be encoded with the remaining Midi channels.	Split modes 1-3 treat Midi, CVC, and internal sounds all the same. See note after this table.
3	Split into a monophonic high range and polyphonic low range. All pitches above the split point will be encoded on Midi channel 1, and the pitches below the split point will be encoded with the remaining Midi channels.	Split modes 1-3 treat Midi, CVC, and internal sounds all the same. See note after this table.
4	Split into internal synthesizer low range and external synthesizer (and CVC if connected) high range. All pitches below the split point will be played by the internal synthesizer and not sent to Midi Out, and the pitches above the split point will be sent to Midi Out and CVC but not played internally.	The full polyphony will be used for the external synthesizer and/or CVC, and the full polyphony will be used for the internal synthesizer.
5	Split the playing surface into internal synthesizer high range and external synthesizer (and CVC if connected) low range. All pitches above the split point will be played by the internal synthesizer and not sent to Midi Out, and the pitches below the split point will be sent to Midi Out and CVC but not played internally.	<p><b>For example:</b></p> <p>With a polyphony of 4, 8 total notes are possible: 4 from Midi or CVC, and 4 from the internal synth.</p>

**Notes:**

If you want a monophonic CVC range and a polyphonic Midi range on different side of the split, use mode 2 or 3. Then use the first 4 outputs on the CVC and ignore the other outputs. For Midi, use channels 2,3,4,5,6,etc but ignore channel 1.

For an additional way to control Midi channel usage, see Section 4.6.

Multi-split is available via Midi (Section 7.5) or Kyma; these multi-splits are not reflected in the Editor.

## 4.13 Mono Function and Mono Interval

Single-note lines can be performed with legato, retrigger, or portamento transitions between notes; transitions can be pressure-based or time-based (see Section 1.9 for details). The Mono Function lets you select what kind of transitions to use.

<b>Mono Function</b>	
0	Portamento - no retriggering, and smooth pitch transition is implemented, based on the relative Z values of the two notes.
1	Legato Z - no retriggering during transition, highest Z finger is played
2	Retrigger Z - retrigger when the mono transition occurs, highest Z finger is played
3	Legato T - no retriggering during transition, finger that most recently touched surface is played
4	Retrig New - retrigger when a finger first touches the surface
5	Retrig All - retrigger when a finger first touches surface and when finger is lifted

The Mono Interval allows you to play single-note lines when the Continuum Fingerboard is configured with polyphony greater than 1. If you play two notes within the Mono Interval, a legato, retrigger, or portamento transition will be used, as selected by the Mono Function. You can set any number of half steps for the Mono Interval by touching “Mono Interval” and then a value corresponding to the number of half steps. If you select value 0 or if the Mono Switch is off, the Mono Interval function will be disabled.

<b>Mono Interval</b>	
0	Disabled.
1 to 127	Sets the range in halfsteps of the mono interval.
	The Continuum Editor has a reduced selection set comprised of the most useful values. As well, the Mono Function can be enabled and disabled via the switch in 4.13 in the Editor Legend.

If you configure a nonzero Mono Interval you can activate and deactivate that interval using the Mono Switch, as described in Section 7.1, or via the Editor as described above.

---

## 4.14 Round Initial and Release Rounding

**Round Initial:** When Round Initial is selected, the Continuum Fingerboard corrects the finger position each time a finger first touches the surface. This aids a player in creating equal temperament pitches and intervals, or pitches and intervals in alternate tunings (see Section 4.16). Subsequent vibrato and glissando finger moves are interpreted at full micro-pitch resolution until a new note is sounded. Please thoughtfully consider the pros and cons of rounding finger position in Section 1.10 before using this feature.

**Release Rounding:** When Release Rounding is selected, pitch correction occurs when a note is still sounding after the finger is lifted from the surface, but not during sustained notes. With Release Rounding, the Round Rate (Section 4.15) takes effect only after a finger is lifted. See Section 1.10 for details.

Round Initial and Release Rounding	
0	Round Initial and Release Rounding disabled
1	Round Initial enabled, Release Rounding disabled
2	Round Initial disabled, Release Rounding enabled
3	Round Initial and Release Rounding enabled

---

## 4.15 Round Rate

The Round Rate will automatically round finger positions to the nearest half step any time during a note and after the finger is lifted. After you complete a glissando, it can automatically correct your pitch. If you are playing vibrato the average finger position will be rounded so that the vibrato will be centered at the nearest half step. Please thoughtfully consider the pros and cons of rounding finger position in Section 1.10 before using this feature.

Round Rate	
0	No Rounding (default setting).
1 to 127	Small Round Rates cause a slow drift to half-step finger positions; larger rates round more quickly. The maximum Round Rate of 127 causes immediate rounding; with this rate you will get a piano-style glissando when you slide a finger over several half steps.

Notes:

- (1) This Round Rate mechanism is a separate feature from Round Initial (Section 4.14), and it may be used with or without Round Initial.
- (2) You can limit the Round Rate to have effect only after a finger is lifted using the Release Rounding feature (Section 4.14).
- (3) You can use foot pedals to influence the round rate as you play; see details in Section 7.1.

## 4.16 Tuning

The Continuum Fingerboard allows you to choose between Just, n-tone per octave, Equal, and custom downloadable tunings for rounding finger positions to the nearest half step.

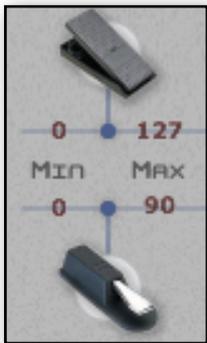
<b>Tuning</b>	
0	12-tone equal tempered (default setting).
1 to 50	N-tone Equal tuning, where N is a number from 1 to 50.
60 to 71	Twelve Just tuning tonic centers. You will notice that the value “0” lines up with Middle C, so if you touch “Tuning”, then “60+”, then middle C, the Just C tuning (value 60) will be selected; the C#, Just C# tuning (value 61) will be selected; etc. In this Just tuning, any of the major triads (I, IV, V) will have perfect 4:5:6 frequency ratios in the rounded finger position, and the ii and vi minor triads will have perfect 10:12:15 frequency ratios.
80 to 87	Eight downloadable custom tunings. Please note: The downloadable tunings can be used to warp the playing surface, even if you do not have Round Initial or Round Rate configured. For information on defining your own custom tunings, please see Section 8.
	The Continuum Editor has a reduced selection set comprised of the most useful values.

## 4.17 Pedal 1 and Pedal 2

Use Pedal 1 and Pedal 2 to select a Midi controller (cc) for the quarter inch pedal jacks (Section 1.13). The pedal jack data values are truncated to 7 bits for Midi, but the EaganMatrix and the CVC use the exact pedal data values (no truncation).

Pedal 1 and Pedal 2 must be one of several controller numbers that has special meaning to the Continuum Fingerboard. For example, 64 is Sustain, 66 is Sostenuto, 69 is a second Sostenuto, 20 is Octave Shift, 21 is Round Switch, 22 is Instant Round, and 23 is Mono Switch, 12 and 13 is Reverb Time and Reverb Mix for the Internal Sound (see Section 7.1).

Pedal 1	
12-31, 50, 64-69, 80-83	Continuous controller number (cc) for pedal 1.
	The pedal can be assigned to any of the controls on the long Pedal 1 slider, labeled 4.17 in the Editor Legend at the beginning of this section.
Pedal 2	
12-31, 50, 64-69, 80-83	Continuous controller number (cc) for pedal 2.
	The pedal can be assigned to any of the controls on the long Pedal 1 slider, labeled 4.17 in the Editor Legend at the beginning of this section.



### Min and Max (Editor only)

Min and Max sets the output range of the pedal jacks. This allows for fine control of subranges of parameters. Making Min greater than Max will invert the pedal action. In this picture Pedal 1 has a normal full range, from 0 to 127. Pedal 2 has a range from 0 to 90. For the EaganMatrix and the CVC, reducing the pedal range does not reduce accuracy.

For switch pedals, Min specifies the value when the pedal is at rest, and Max when the pedal is pressed.

## 4.18 Options

Less frequently used configuration choices are grouped under Options. For a more detailed explanation of what each of these options does, refer to the text after the table below. Options 9, 11, 12, 13, and 127 are available only from the Overlay Strip or Midi In (Section 7.4).

Options	
0	This will disable any of the Options below that were previously enabled.
1	Preserve existing performance parameters when opening presets.  On the Global page of the Continuum Editor.
2	Light Action.  On the Global page of the Continuum Editor.
3	Digital audio output syncs to digital audio input.  AES options are on the Global page of the Continuum Editor.
4	Digital audio output rate at 48 kHz.  AES options are on the Global page of the Continuum Editor.
5	Make octave foot switch transpose two octaves instead of one octave.  4.18b
6	Make octave foot switch transpose four octaves instead of one octave.  4.18b
7	Reverse X (pitch), so that the lower notes are to the right and the higher notes to the left.  4.18a
8	Bend Reset.
9	Kyma mode.  4.3
10	21-bit X resolution (controller 85).
11	14-bit Y resolution (controller 87).
12	14-bit Z resolution (controller 86).
13	Disables Continuum Fingerboard's internal reverb.  Reverb option is on the Global page of the Continuum Editor.
127	Factory reset.

See additional text for each option below.

**Option 0:** No additional text.

**Option 1:** When a preset is opened from your Mac or Windows computer, or when a preset is loaded from an Internal User Preset Slot, this will preserve the existing values of the following performance parameters:

Note Priority, Normal/Reverse Pitch, Split, XBend, Y Controller, Z Controller, Midi Note Velocity, Transpose, Midi Routing, Midi Program, CVC Voltage Range, Pedal Assignments, Pedal Min/Max, Audio In Level, Octave Pedal Effect, Mono Switch, Mono Interval, Mono Function, Round Rate, Tuning Grid, and Kenton Rotary assignments.

**Option 2:** Continuum Fingerboards built after 2012 are capable of Light Action, responding to lighter finger pressure than the Medium or Classic Action. If extra notes play after you choose Light Action, use Calibrate+1 after a few minutes of playing (see Section 2).

**Option 3:** Use external clock sync from the AES3 input. The Continuum Fingerboard's Led will shine purple if this option is selected and no valid digital sync is present at the AES3 input. The led will switch to blue when sync is present.

**Option 4:** Causes the external digital audio output to transmit at 48 kHz instead of the default rate of 96 kHz.

**Option 5 and 6:** Additional transposition values are available using the Continuum Editor. Settings can range from +- 4 octaves in one octave increments.

**Option 7:** No additional text.

**Option 8:** Bend Reset

This will reset pitch bend 100 ms after the finger is lifted. This is provided for synthesizers or software that impose a maximum rate for pitch bend or do not preserve the order of Midi Pitch Bend and Key On messages. Such synthesizer limitations will cause problems: the note following a long glissando will have an audible pitch glissando when it starts. You can work around this problem by enabling Pitch Bend Reset.

**Option 9:** Special Midi handling for Symbolic Sound Corporation's Kyma. This transmits a Midi message once per second to let Kyma know a Continuum Fingerboard is present. The Continuum Fingerboard will use controller 74 to encode Y, controller 11 for Z, and 96 for the pitch bend range. Splits in Kyma override the Continuum Fingerboard's split. Technical detail: In this special Kyma mode, Continuum notes are transmitted on high-numbered Midi channels starting with channel 16.

To connect both a Midi Keyboard and Continuum Fingerboard to Kyma at the same time: The Continuum Editor must be running, it must have the Midi keyboard as its ExtDevice input, the Keyboard must transmit on Midi channel 1, and the Midi Routing in the Continuum must pass Midi In to Midi Out. Technical detail: The Editor routes the ExtDevice to the Continuum, and the Continuum moves channel 1 KeyOn/KeyOff messages to high-numbered Midi channels, one note per channel.

**Option 10:** Encode pitch bend with 21 bits

The Continuum Fingerboard can transmit Midi pitch bend with extended precision. Controller 85 provides 7 additional bits of pitch bend information, for a total of 21 pitch bend bits. The synthesizer must be programmed to save the data value when controller 85 is received; this data value will have no effect until the next pitch bend value is received by the synthesizer – at that time, the synthesizer appends the saved data value to the least significant bits of the pitch bend value, making for a more precise value.

**Option 11:** Encode front-back position (Y) with 14 bits

The Continuum Fingerboard can transmit front-back position with extended precision. Controller 87 provides 7 additional bits of pressure information, for a total of 14 bits. The synthesizer must be programmed to save the data value when controller 87 is received; this data value will have no effect until the next Y controller value is received by the synthesizer – at that time, the synthesizer appends the saved data value to the least significant bits of the Y value, making for a more precise value.

**Option 12:** Encode pressure (Z) with 14 bits

The Continuum Fingerboard can transmit finger pressure with extended precision. Controller 86 provides 7 additional bits of pressure information, for a total of 14 pressure bits. The synthesizer must be programmed to save the data value when controller 86 is received; this data value will have no effect until the next pressure controller value is received by the synthesizer – at that time, the synthesizer appends the saved data value to the least significant bits of the pressure value, making for a more precise value. (The Continuum Fingerboard's extended precision mechanism is synchronous, and it is separate and distinct from the Midi standard 14-bit controllers, which suffer from update glitches because the MSB and LSB values are asynchronously updated.)

**Option 13:** No additional text.

**Option 127:** Factory reset

This sets all presets (the current configuration as well as Internal User Preset Slots 1-10) and the Global options to factory default. If you are having trouble with your presets, you may want to run the Continuum Editor on your computer to inspect and/or change all the presets.

---

## 4.19 Send

Send	
1	Transmit current configuration via Midi, using the messages described in Section 7.4.

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## 4.20 Load and Store

There are 10 Internal User Preset Slots in the Continuum Fingerboard, numbered 1 through 10. Each Internal User Preset Slot holds a complete configuration of the Continuum Fingerboard (except for a few settings that are Global and are common for all presets). Normally it is preferable to open and save Preset files stored on your Computer's disk (see Section 4.21), but when you do not have your computer connected to your Continuum Fingerboard, the Internal User Preset Slots give you access to 10 presets you stored internally in your Continuum Fingerboard.

<b>Load</b>	
1 to 10	<p>This will load from the selected Internal User Preset Slot.</p> <p>A single-touch alternative is available for loading presets from the surface: Press the red button and then press the playing surface on the opposite side of the Overlay Strip, at the desired preset number. This saves the intermediate step of pressing "load".</p> <p>A hardware alternative is also available for loading presets: The Kenton Mini Controller, together with a Kenton USB Midi Host, provides lighted indicators and buttons for loading presets. See Section 1.14.</p>
	<p>Press Command+1..9 (Mac) or Control+1..9 (Windows) to load from Internal User Preset Slot 1..9, press Command+0 or Control+0 to load from Internal User Preset Slot 10, or, on the Map page, click on the Internal User Preset Slot you wish to load.</p>
<b>Store</b>	
1 to 10	<p>This will store into the selected Internal User Preset Slot. It will also store the Global settings internally.</p>
	<p>Press Shift+1..9 to store current configuration to Internal User Preset Slot 1..9, Shift+0 to store current configuration to Internal User Preset Slot 10, or drag a Preset file from the Finder (Mac) or Explorer (Windows) and drop it onto one of the 10 Internal User Preset Slot areas on the Map page.</p>

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## 4.21 Open Preset, Save Preset, Open Preset Group, Save Preset Group (Editor Only)

### Open Preset

To open a Preset file on your Mac or PC, choose Open in the Preset popup menu, or press Command+O (Mac) or Control+O (Windows), or drag a file from the Finder (Mac) or Explorer (Windows) and drop it onto the Editor's Preset popup area. A Preset file holds a complete configuration of the

Continuum Fingerboard (except for a few settings that are Global and are common for all presets). You can find Preset files in the Archives folder within the Continuum Editor's folder, or anywhere else on your computer where you have previously saved Preset files.



### Save Preset

To save a Preset File on your Mac or PC, choose Save in the Preset popup menu, or press Command+S (Mac) or Control+S (Windows). The name you choose for the file will be the preset name, and will be reflected in the Continuum Editor.

### Internal User Preset Slots

In addition to opening and saving Preset files on your computer, you can also load and store presets into the 10 Internal User Preset Slots inside your Continuum Fingerboard. It is preferable to use Preset files stored on your Computer's disk, but when you do not have your computer connected to your Continuum Fingerboard, the Internal User Preset Slots give you access to 10 presets you stored internally in your Continuum Fingerboard. See Section 4.20 for Loading and Storing individual presets in the Internal User Preset Slots.

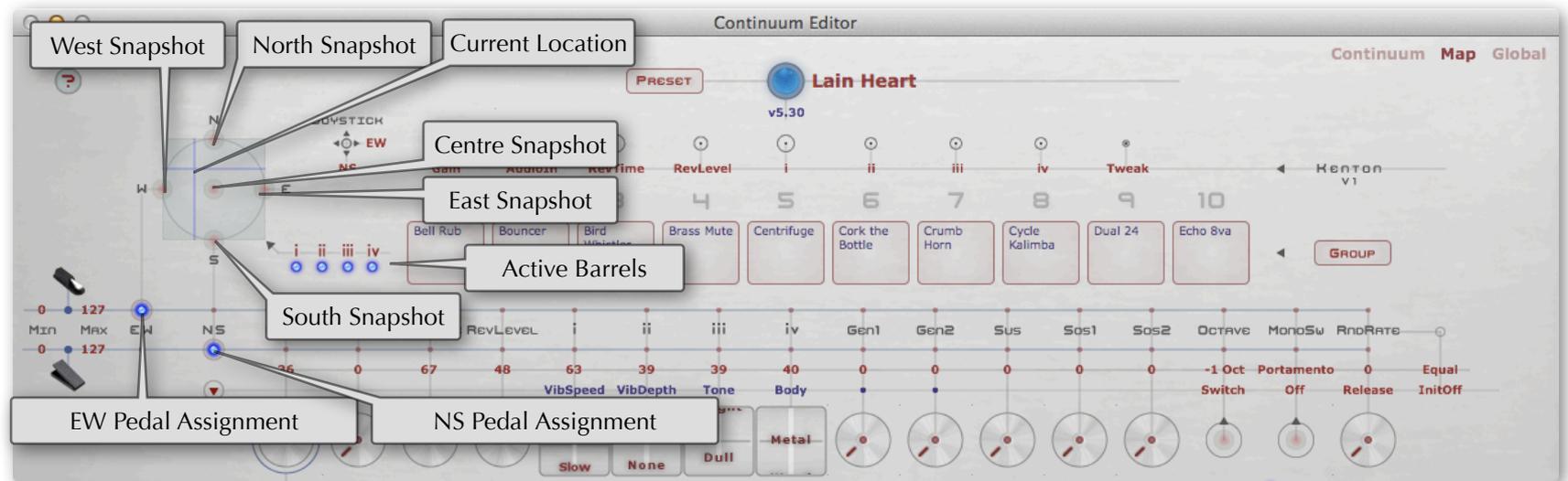
### Open Preset Group

To open a Preset Group file on your Mac or PC, choose Open in the Group popup menu on the Continuum Editor's Map page, or drag a Preset Group file from the Finder (Mac) or Explorer (Windows) and drop it onto the Editor's Group popup area. A Preset Group file contains a list of Preset files for the Internal User Preset Slots. When you open a Preset Group file, the Internal User Preset Slots will be updated to contain the presets listed in the Preset Group file.

## Save Preset Group

To save a Preset Group onto your Mac or PC, go to the Continuum Editor's Map page, select the last Internal User Preset Slot you want included in the Preset Group file, then choose Save in the Group popup menu. This Save Group option will create the Preset Group file as well as individual Preset files. For example, if you click on the Map Page's Internal User Preset Slot 5 and then choose Save in the Group popup menu, you will get a Preset Group file that contains the list of Internal User Preset Slots 1..5, as well as 5 Preset files (one for each listed preset).

## 4.22 NSEW (Editor Only)

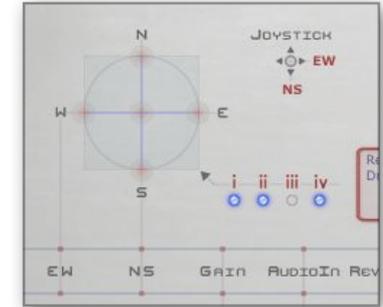


The NSEW (North South East West) on the Editor's Map page is used to create two-dimensional morphs between i,ii,iii,iv barrel values. The i,ii,iii,iv barrel values can in turn have complex effects on how timbre is controlled by fingers on the playing surface. The NSEW only has effect on EganMatrix sounds, and does not work with Specialty sounds.

The Current Location within the NSEW is determined by the NS and EW controllers. In the example shown above, Pedal 1 is configured to be the WE controller, and Pedal 2 is configured to be the NS controller.

There are a total of 5 Snapshot Points within the NSEW, called North Snapshot, South Snapshot, East Snapshot, West Snapshot, and Centre Snapshot. Each snapshot point stores values for the four i,ii,iii,iv barrels. When the NSEW is used in performance, the i,ii,iii,iv barrels will smoothly morph their values based on the Current Location. In the example above, the Current Location is nearest the Center Snapshot, so currently the barrel values are a morph of the Center Snapshot's values and (to a lesser extent) the West Snapshot and North Snapshot values.

Associated with each of the 5 Snapshot Points is a Snapshot Button. To program a Snapshot Point within the NSEW, first set barrels i,ii,iii,iv to the desired values, and then hold down Shift as you click the Snapshot Button to save those values at that Snapshot Point. At a later time you may hold down Command (Mac) or Control (Windows) as you click on a Snapshot Button to recall the i,ii,iii,iv values at that Snapshot Point. The four Barrel values you save at each of the 5 Snapshot Points will be remembered when you save the Preset. You may configure the NSEW to affect only a subset of the i,ii,iii,iv barrels, but still all four barrel values will be remembered by the NSEW. The NSEW at right will affect barrels i, ii, and iv, but not barrel iii.



NS and EW can come from Pedal 1 and Pedal 2 (as shown above), from the Kenton Mini Controller Joystick or Rotaries, or from Midi In to the Continuum (Section 7.1). The NSEW will have no effect on i,ii,iii,iv values until the first time the Current Location changes (which happens the first time either NS or EW changes). In other words, if neither the NS nor EW controllers are used, the NSEW has no effect.

#### 4.23 ? Menu: User Guides, Editor Shortcuts, Predefined Timbre Data, Convolution Responses, Barrel Styles, About

##### ? Menu: User Guides



Select "Continuum User Guide," "EaganMatrix User Guide," or "CVC User Guide" to launch a window showing the Guide. The User Guide pdf files are located in the User Guides folder inside your Continuum Editor folder.

##### ? Menu: Editor Shortcuts



Select "Editor Shortcuts" to see a reference list of keyboard shortcuts and mouse drags available in the Continuum Editor.

##### ? Menu: Predefined Timbre Data



Select "PredefineTimbre Data" to view a list of predefined data available for the GrainSilo. Each of the two GrainSilos may optionally select one of these predefined timbres; see the EaganMatrix User Guide for details.

##### ? Menu: Convolution Responses



Select "Convolution Responses" to view a list of responses available for the two convolutions in the Master section of the EaganMatrix. Each Master section convolution allows you to dynamically interpolate between two of these responses.

## ? Menu: Barrel Styles



Select "Barrel Styles" to view a compendium of barrel display styles available for the i, ii, iii, iv barrels in EaganMatrix sounds you design. This Barrel Styles display allows you to try out each barrel.

## ? Menu: About



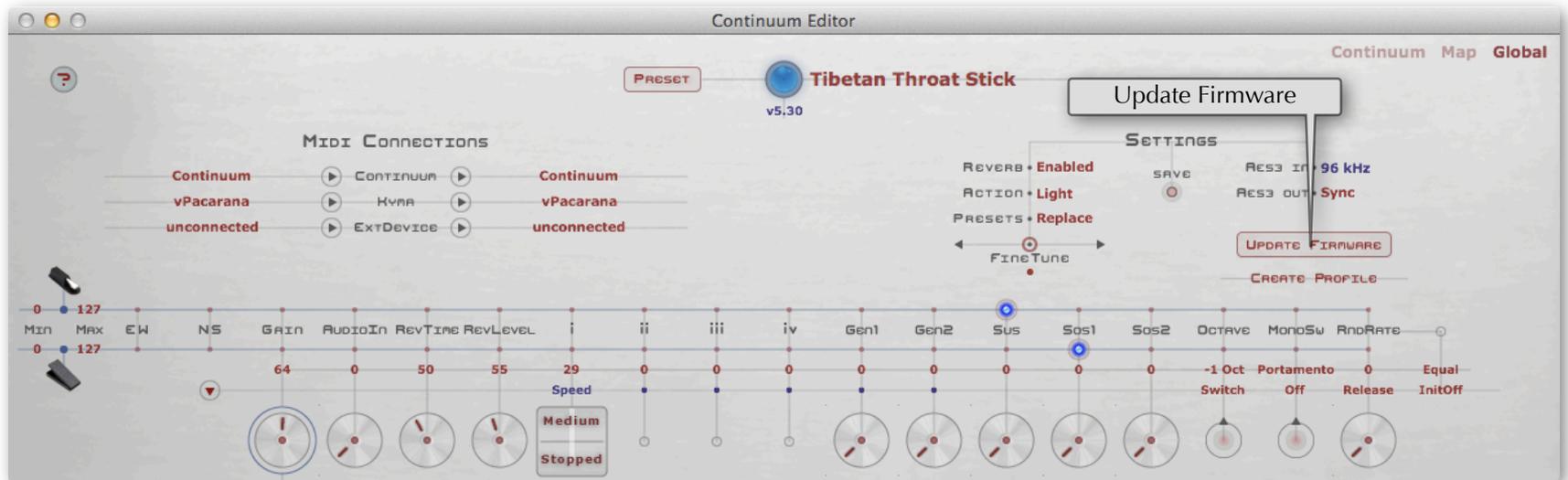
Select "About" to see the Editor version, as well as information on the Editor authors Edmund Eagan and Lippold Haken.

## 5 Loading New Firmware into the Continuum Fingerboard

New firmware is supplied from Haken Audio as a pair of firmware files.

If you have presets you previously created and stored in your Continuum's Internal User Preset Slots, please save those presets (using your old Editor) to your Mac or PC before updating firmware. Then, to update the firmware:

1. Run the new Continuum Editor (available in the Resources area at [www.HakenAudio.com](http://www.HakenAudio.com)). Make sure the Editor is communicating with your Continuum Fingerboard as outlined in Section 3.3, then go to the Continuum Editor's Global page.



2. Keep the Continuum Editor running. In the Finder (Mac) or Explorer (Windows), navigate to the directory with the new firmware files. Haken Audio supplies the firmware as two files in a folder called Firmware within the Continuum Editor folder.
3. Drag the first firmware file and drop it onto Update Firmware on the Global page (see image above). The Editor will start loading the data into the Continuum. During this process the Continuum Fingerboard's LED will shine yellow, and the Editor will display a progress percentage. The LED should eventually change to blue and the download status display in the Continuum Editor will report success. The Continuum Fingerboard will need to be power cycled for this first Firmware file to come into effect; follow the on-screen instructions after your first Firmware download is complete before proceeding to step 4.
4. Drag the second Firmware file and drop it onto Update Firmware on the Global page. The LED will shine yellow; when it changes back to blue the download status display will report success. Your firmware update is now complete, no power cycle is necessary.
5. Calibrate your Continuum Fingerboard, as described in Section 2 of this User Guide.
6. If there is a problem with your firmware update, the Continuum Editor will report failure. Refer to the chart below for problems that can occur using some types of Midi interfaces. Certain interfaces will appear to work with the Continuum during normal use, but can have problems during a data firmware download. These same failing interfaces can have subtle and random problems with large amount of performance data, and in general should be avoided for use with the Continuum.

<b>Midi Interfaces</b>	
Known to work well during firmware data transfers and for general Continuum use	Roland Cakewalk, Roland Edirol, Yamaha Interfaces, Motu MTP AV, Motu Micro Lite
Known to have issues during firmware data transfers	M-Audio Interfaces, Emagic AMT8, Emagic Unitor 8, Emagic MT4, Presonus Firestudio, TC Konnect 24D

If changing the Midi interface doesn't help, please contact Haken Audio. If you do find an unlisted interface that does/doesn't work, contact Haken Audio so we can add it to this list.

If you want to purchase an inexpensive and reliable USB-Midi interface, we have had good experience with the Roland UM-ONE.

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## 6 Hardware Maintenance

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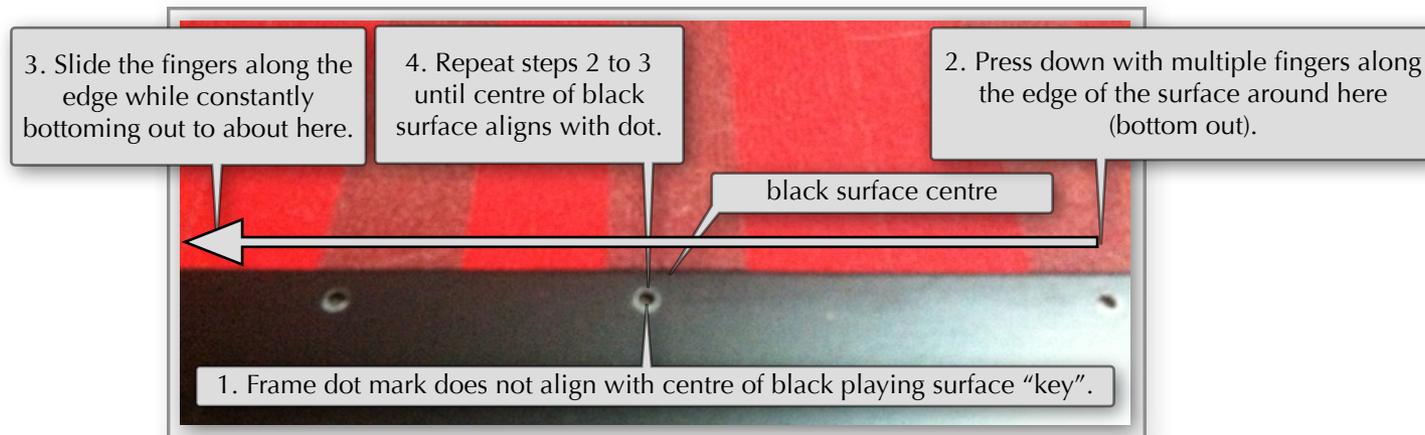
### 6.1 Cleaning

The Continuum Fingerboard can be treated much like any modern electronic device. If you feel the Continuum Fingerboard playing surface or body requires cleaning, wipe with a slightly damp cloth. If necessary, you can use a cleaning agent like Windex. Never spray a cleaning material directly on the Continuum Fingerboard.

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### 6.2 Surface Alignment

A Continuum Fingerboard with a plain (unmarked) playing surface does not have surface alignment problems. But Continuum Fingerboards that have reference markings on the playing surface must have the “black key” areas on the playing surface aligned with the precise dot markings on the frame around the playing surface. The playing surface may eventually come out of alignment, usually due to overly vigorous playing. To correct this surface alignment problem, press multiple fingers on the playing surface and move it into position. Refer to the step by step instructions in the diagram below. If you have trouble with this, please contact Haken Audio. Please do not open up your Continuum Fingerboard without instructions from Haken Audio; hundreds of springs may come out of position in the playing surface unless the proper procedure is followed.



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## 6.3 Hardware Problems

If you suspect your Continuum Fingerboard is not functioning properly, please try the following:

**If you are using an external synthesizer, reset and test your synthesizer:**

Power cycle and do a full reset on your synthesizer, then test the synthesizer with a standard Midi keyboard, to ensure the synthesizer is in a known working configuration.

**Recalibrate:**

Perform the calibration procedure described in Section 2.

**Try the built-in synthesizer:**

Connect headphones and play internal sounds. If this works, then you probably have a Midi configuration problem.

**Discard all Internal User Presets and reconfigure:**

Discard all the presets using Options then 127, as outlined in Section 4.18. Use Section 4 to guide you in reconfiguring your Midi encoding.

**Boot in "Safe Mode":**

Please contact technical support before you resort to this. If you suspect problems with your firmware, you can revert to the factory-programmed firmware. Turn off power, press and hold the Red Button, then turn on the power as you keep the button pressed. Wait until power-up completes and the light flashes dim blue before you release the button. The light will continue to flash all the time, indicating a Safe Mode boot. You will need to recalibrate and set configuration options.

**Other things to try:**

If you are still having problems, please contact technical support. It may be that new firmware will correct the problem you are seeing. If it is a hardware problem, the procedures below may be effective in hiding the problem, but it is important to inform tech support so that any necessary repairs can be made as soon as possible. You can have Haken Audio make repairs, or (for most repairs) you can obtain instructions from Haken Audio to make the repairs yourself.

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## 6.4 Sensor Stuck On, or Sensor Intermittently Turn On

The Continuum Fingerboard has hundreds of Hall-Effect sensors. In the unlikely event that a sensor has a hardware failure, this can cause a sensor to be stuck on, or intermittently turn on, causing spurious notes. To quiet such a sensor, press and release the Red Button, then touch "Calibrate", then value "1". This will set the at-rest threshold for the sensors and should quiet any sensor that was active while you first pressed the button. This procedure is necessary even if there is no hardware problem, if you have Light Action (Section 4.18) selected.

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## 6.5 Sensor Stuck Off – Marking a Flawed Sensor

If a normalized sensor value is stuck off, this can cause gross discontinuities in pitch (more than 40 cent jumps) on the Continuum Fingerboard's playing surface, or it can cause two notes to sound (with pitches about 85 cents apart) for a single finger. Please contact technical support to discuss the situation and verify the cause of the problems – pitch discontinuities and note doubling can be caused by Midi problems and other problems as well.

To mark a stuck-off sensor as flawed, press and release the Red Button and touch "Calibrate", then value "10". The LED will shine violet. Touch a finger on the playing surface location corresponding to the pitch discontinuity. When the flawed sensor is detected, the LED will shine dim blue. (If you decide to skip it, you can press the button again to return to normal operation without marking a flawed sensor.) A sensor that is marked flawed will not be used in the finger tracking, and thus the pitch discontinuity should be resolved.

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## 6.6 Clearing the Flawed Sensor List

To clear out the list of sensors marked as flawed, press and release the Red Button, touch "Calibrate" then value "11."

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## 6.7 Do - It - Yourself Repairs and Adjustments

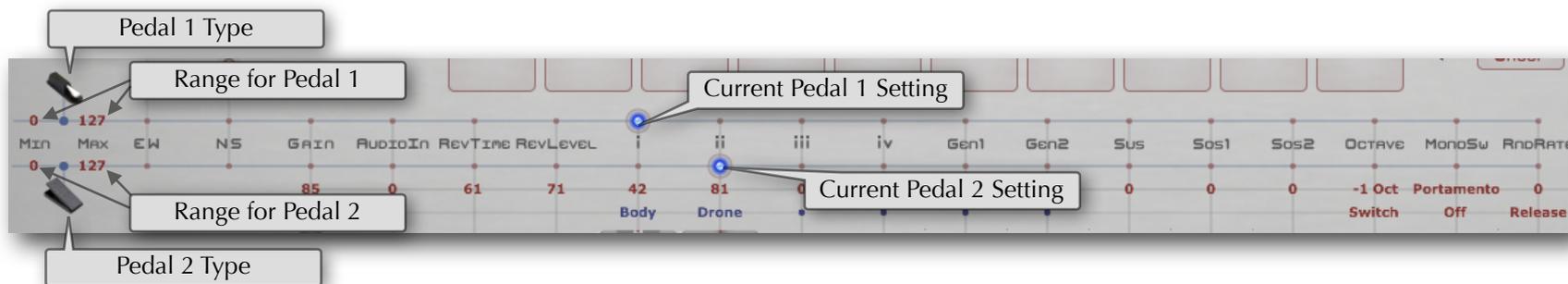
If you loosen the screws in the Continuum Fingerboard, hundreds of springs inside your Continuum Fingerboard may slide out of position, causing serious damage to your instrument. If you wish to perform modifications or repairs on your Continuum Fingerboard, please discuss your situation with Haken Audio technical support and obtain an up-to-date Continuum Fingerboard Repair Manual. After you read the repair manual, you can decide if you would rather have Haken Audio do the repairs for you.

## 7 Configuration via Midi

Channel 16 Midi input to the Continuum Fingerboard has special functionality as described in the following sections.

### 7.1 Performance Pedals

This section describes the controller assignments on channel 16 for performance pedals. Any of these may be assigned to the ¼ inch pedal inputs on the Continuum Fingerboard (see Section 4.17). All these options are available in the Continuum Editor via these controls, mapping the two long sliders to the desired control option:



*Here Pedal 1 is assigned to Barrel 1 and Pedal 2 is assigned to Barrel 2.*

Even if a control is not mapped to a Pedal, its value can still be edited by interacting with the control using the mouse, the Kenton Mini Controller, or a third party device. Please note: If you use a third-party device to supply pedal values while the Editor is running, you may want to send the values to the Continuum on channel 15 instead of channel 16; see the discussion of Echo Next in Section 7.4

Min and Max set the output range of the pedal jacks (see Range for Pedal in the picture above). This allows for fine control of subranges of parameters. Making Min greater than Max will invert the pedal action. For switch pedals, Min specifies the value when the pedal is at rest, and Max when the pedal is pressed. In the above picture Pedal 1 and Pedal 2 are set to a normal full range, from 0 to 127.

<b>Continuous Controller Assignments (Channel 16)</b>	
cc 12 Reverb Time	Internal sound reverb time.
cc 13 Reverb Mix	Internal sound reverb mix. 0 is dry, 1 is 100% through reverb.
cc 14 NorthSouth (NS)	Used with the NSEW to interpolate between controller i,ii,iii,iv snapshots (Section 4.22).
cc 15 EastWest (EW)	Used with the NSEW to interpolate between controller i,ii,iii,iv snapshots (Section 4.22).
cc 16 Gen1 cc 17 Gen2	Gen1 and Gen2 are used with the EaganMatrix. Gen1 also is used to control release time for certain internal sounds.
cc 20 Octave Switch	Transpose the playing surface by one octave. The Octave Switch may be configured to shift a different number of octaves (see Section 4.18).
cc 23 Mono Switch	The Mono Switch enables single-note lines when Polyphony is greater than 1, for notes that are within the Mono Interval (see Section 1.9 and Section 4.13).
cc 24 i	The Continuum Fingerboard's internal sound parameters "i", "ii", and "iii" (see Section 4.2).  These may also be set using the Overlay Strip's i, ii, iii.
cc 25 ii	
cc 26 iii	
cc 27 iv	The Continuum Fingerboard's internal sound parameter "iv" (see Section 4.2).
cc 28 Round Rate	Sets the rate for the Continuum Fingerboard's finger position rounding feature (see Section 1.10 and Section 4.15).
cc 29 AES Input Level	Level for AES input.

<b>Continuous Controller Assignments (Channel 16)</b>	
cc 30 Gain	Output gain level of the internal sound. See Section 4.1.
cc 31 Red Switch	An alternative to the Red Button for initiating configuration from the surface.
cc 64 Sustain  cc 66 Sostenuto 1  cc 69 Sostenuto 2	The Continuum Fingerboard supplies one sustain and two sostenuto pedals. These pedals are dynamic: if the pedal's data value is 127, the sustain or sostenuto will be at full volume; smaller pedal values can be used for lower volume (if you use a continuous-valued pedal as opposed to a switch pedal). The Continuum Fingerboard will wait until the sustain or sostenuto pedal is released before it sends Midi Note Off. If you use a continuous-valued pedal and release it gradually, the sustained notes will fade out. If you use the two sostenuto pedals at the same time, you can control two sets of sostenuto notes.

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## 7.2 Duplicate and Merge

The Continuum Fingerboard merges Midi In messages it receives with the Midi generated by fingers touching the playing surface. By default this merged Midi is sent to Midi Out, the internal sound, and the CVC. You can configure the Merge function as described in Section 4.3.

Since the Continuum Fingerboard transmits on multiple Midi channels, you may want Midi cc data to affect all of those Midi channels. The Continuum Fingerboard will automatically duplicate and merge continuous controller cc 80-83 messages and program changes received on channel 16 to all the channels it currently uses to the Midi Out. This duplication can cause buffer overruns when overused.

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## 7.3 High resolution modes

The Continuum Fingerboard can transmit finger X, Y and Z with extended precision. The synthesizer must be specially programmed to make use of this information. See Section 4.18 and 7.4 for details.

## 7.4 Configuration via Midi Channel 16

Internal configuration can be set and read via Midi controllers on channel 16. This method is utilized by the Continuum Editor, and may also be utilized by Midi pedal boards or other 3rd party software.

<b>General Configuration</b>		
cc 34 Internal Sound	Select a Specialty Sound (see Section 4.2) with values 0-17. Select an EaganMatrix System Preset with values 18-99. Load from an Internal User Preset Slot (Section 4.20) with values 101-110.	0-17 specialty sounds, 18-99 EaganMatrix, 101-110 user presets
cc 39 Polyphony	Number of simultaneous notes tracked by the playing surface.	1-16, 8 is default
cc 35 Midi Program	Transmit Midi program change on each Midi channel used by the Continuum Fingerboard. The Midi program change will be transmitted immediately, and whenever this preset is loaded.	0-126, 127 disables this
cc 36, bits 0-2 Surface Routing	The Continuum Fingerboard's surface activity may be merged to any or all of the following: Midi Out, Continuum Voltage Converter (CVC), and Internal Sound.	bit 0 for Midi Out, bit 1 for Internal Sound, bit 2 for CVC
cc 36, bits 3-5 Midi In Routing	The Continuum Fingerboard's Midi In may be merged to any or all of the following: Midi Out, Continuum Voltage Converter (CVC), and Internal Sound.	bit 3 for Midi Out, bit 4 for Internal Sound, bit 5 for CVC
cc 49, bits 2-4 Channel Priority	Select LVN if you want notes generated from fingers on the playing surface assigned to the lowest channel number available; if you do not select LVN, the least recently used (LRU) channel will be used. Select High 1, High 2, High 3, or High 4 to restrict notes from the playing surface to the highest Midi channel(s) within the polyphony (see Section 4.6).	0 LRU, 1 LVN, 2-5 High 1 to 4
cc 33, bits 3-4 Aes3 Options	Select the Aes3 output sample rate. This rate can be internally generated or slaved to the Aes3 input sample rate.	0 96 kHz, 1 Slave, 2 48 kHz
cc 109 Transmit Config	The Continuum Fingerboard will transmit the current configuration on its Midi Out jack, using the same Midi messages used to download the configuration.	16 transmit config
cc 55, bit 0 Transmit Updates	The Continuum Fingerboard will automatically transmit the current configuration whenever the configuration changes, using the same Midi messages used to download configurations.	0 no updates (default), 1 transmit updates

<b>General Configuration</b>		
cc 102 Firmware Version	High 7 bits of firmware version. This is included in the Continuum Fingerboard's response to Transmit Config and Transmit Updates (see above).	0-127
cc 103 Firmware Version	Low 7 bits of firmware version.	0-127

<b>X, Y and Z Coding</b>		
cc 44 Middle C	Midi note number corresponding to middle C position.	0-127 60 is default
cc 54 Octave Switch Configuration	Midi note number corresponding to middle C position while the Octave Switch is pressed.	0-127, 48 is default
cc 41 Y Controller Assignment	Controller assignment for finger Y position (front-back). No value is transmitted for Y if the controller assignment is 0.	1-126, 74 is default, 127 no shelving cc74, 0 no output
cc 42 Z Controller Assignment	Controller assignment for finger Z position (pressure). No value is transmitted for Z if the controller assignment is 0.	1-127, 11 is default, 0 no output
cc 43, bits 0-1 Midi Note Velocity	A value of 0 sets the Note On velocity to a constant maximum (127) . A value of 1 encodes initial finger velocity in the Note On velocity byte. Value 2 avoids transmitting any Note On, Note Off, or Pitch Bend messages. Value 3 makes the Continuum act as a 3-d ribbon controller, providing pitch bends for an external Midi keyboard.	0 constant 127, 1 velocity, 2 no note output, 3 External Note mode
cc 61, bits 4-6 Extended Precision	Transmit an additional 7 bits for X, Y, and/or Z. See Options 11, 12, and 13 in Section 4.18 for details.	bit 4 for 21 bit X bit 5 for 14 bit Y bit 6 for 14 bit Z

<b>Mono Function</b>		
cc 46 Mono Function Configuration	Select between portamento, legato, and retrigger in single note lines. Transitions can be pressure-based or time-based. See Section 1.9 and Section 4.13.	0 Portamento (default), 1 Legato Z, 2 Retrigger Z, 3 Legato T, 4,5 Retrigger New/All
cc 48 Mono Interval	Sequential notes played within the Mono Interval will be performed as single-note lines. The Mono Switch (see Section 7.1) can be used to enable and disable effect of the Mono Interval during a performance.	0 disables this, 1-96 interval, 0 is default
<b>Split Functions</b>		
cc 45 Split Point	Note number for split point.	0-127, 60 is default
cc 43, bits 2-4 Split Mode	Select split mode (see Section 4.12). An alternative split mechanism, Multi-Split, is described in Section 7.5.	0 off, 1 polyphonic, 2,3 single below/above, 4,5 internal b/a
<b>Pedals</b>		
cc 52 Pedal1 Jack	Midi controller assignment for Pedal1 Jack.	See Section 7.1, 64 is default
cc 76 Pedal1 Min	Minimum data value for Pedal 1.	0-127, 0 is default
cc 77 Pedal1 Max	Maximum data value for Pedal 1.	0-127, 127 is default
cc 53 Pedal2 Jack	Midi controller assignment for Pedal2 Jack.	See Section 7.1, 66 is default
cc 78 Pedal2 Min	Minimum data value for Pedal 2.	0-127, 0 is default

<b>Pedals</b>		
cc 79 Pedal2 Max	Maximum data value for Pedal 2.	0-127, 127 is default

<b>Continuum Voltage Converter Serial Number</b>		
cc 104 CVC Serial Number	Bits 15-14 of 16-bit CVC serial number. The is included in the Continuum Fingerboard's response to Transmit Config and Transmit Updates (see above).	0-3 high bits serial number
cc 105 CVC Serial Number	Bits 13-7 of 16-bit CVC serial number.	0-127 medium bits serial number
cc 106 CVC Serial Number	Bits 6-0 of 16-bit CVC serial number.	0-127 low bits serial number

<b>Midi Device Compatibility</b>		
cc 61, bit 2 Pitch Bend Reset	Reset Pitch Bend 100 ms after each Note Off (see Section 4.18 for discussion).	1 to activate, 0 is default
cc 61, bit 3 Kyma Mode	Communicate with Symbolic Sound's Kyma; automatically update polyphony and multi-split as Sounds are loaded within Kyma; if the Continuum Editor is running and has a Midi keyboard as ExtDevice, the Continuum will channelize the keyboard data (one note per Midi channel) allowing both Midi keyboard and Continuum connection to Kyma.	1 to activate, 0 is default
cc 112 Echo Next  (Update Editor)	Sent to the Continuum from a third party device ("ExtDevice"), such as a sequencer or hardware controller, when the Continuum Editor is also in use. Prepending this cc 112 message to another controller message will instruct the Continuum to echo that controller message to the Editor, thus updating both Continuum sound and Editor display. Exceptions: (1) Do not prepend cc 112 to cc 34 (Internal Sound); cc 34 will update the Editor display automatically. (2) No cc 112 is required to echo performance pedals (cc 12 through cc 30, Section 7.1) if the performance pedal is sent to the Continuum on channel 15 instead of channel 16. (3) Data for cc 49 can be echoed by sending it via cc 21 on channel 15.	Use any data value.
cc 91 Tweak	When the Continuum Editor is running, this will modify (tweak) the mouseover parameter in the Editor.	0-127

<b>Rounding and Tuning</b>		
cc 49, bit 0 Round Initial	Round initial finger positions to nearest half step (or nearest point in tuning grid).	1 to activate, 0 is default
cc 28 Round Rate	Round finger positions to the nearest point in tuning grid after you complete a glissando, or at any time during a note. The Round Rate determines how quickly the rounding occurs. The Round Switch and Instant Round controllers can override the Round Rate (see Section 7.1).	1-127, 0 disables this, 0 is default
cc 61, bit 1 Release Only	Round rate has effect only after finger is lifted from surface (during release portion of note).	1 to activate, 0 is default
cc 51 Select Tuning Grid	Select Tuning Grid for Round Initial, Round Rate, and surface pitch warping. 60..71 for Just tuning with C..B tonic center. 80..87 for one of eight user-defined downloadable tuning grids. 1..50 for n-tone Equal tuning, with n divisions per octave.	1-50 equal, 60-71 just, 80-87 custom, 0 is default
cc 61, bit 0 Reverse Pitches	Reverse X so that high pitches are to the left and lower pitches are to the right.	1 to activate, 0 is default
cc 109 Initiate Tuning Download	Select one of 8 custom tunings to download. This precedes the custom tuning data. A custom tuning download utility that uses the cc 38 messages below is provided in the Download Resources area at <a href="http://www.HakenAudio.com">www.HakenAudio.com</a> .	80-87 select custom tuning
cc 38 Custom Tuning Data	Each grid point is defined by two numbers: a position on the surface (specified by equal tempered note number with fractional value), and the pitch for that position (specified by note number with fractional value). Tuning tables must be downloaded in increasing grid position order, and at most 500 grid points may be defined in each tuning. Each grid point is transmitted with six pieces of data: 1) Integer part of equal-tempered position (0..127, Midi note number) 2) 7 fractional bits of equal-tempered position (0..127) 3) Additional 7 fractional bits (for a total of 14) (0..127) 4) Integer part of pitch at grid point (0..127, Midi note number units) 5) 7 fractional bits of pitch at grid point (0..127) 6) Additional 7 fractional bits (for a total of 14) (0..127) Normally the first three of these are identical to the last three; if they are not, the cents per inch will not be uniform across the Continuum Fingerboard playing surface.	0-127, 6 bytes per pitch
cc 109 Save Tunings	Save all 8 custom tunings to flash.	101 save tunings

<b>Rounding and Tuning</b>		
cc 109 Transmit Tunings	The Continuum Fingerboard will transmit all 8 custom tuning grids on its Midi Out jack, using the same Midi messages used to download the tuning grids.	100 transmit tunings

## 7.5 Multi-split

Controllers 88 and 89 on Midi channels 1-16 implement multi-split. This overrides the simple split normally used in the Continuum Fingerboard. This multi-split is not stored in saved presets. When using multi-split, set the polyphony to the total of the polyphony of all split ranges.

<b>Multi-split Function (channels 1 - 16)</b>		
cc 88, cc 89 Multi-split	cc 88 specifies the lowest note number allowed on the Midi channel. cc 89 specifies the highest note number allowed on the Midi channel.	0 -127

## 8 Tuning Grids and Custom Tunings

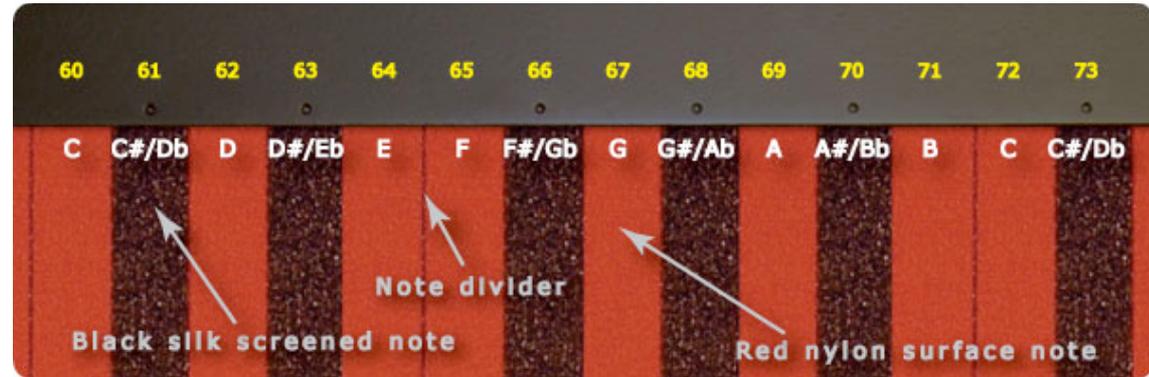
The Continuum Fingerboard requires precise finger positioning techniques. Continuous pitch provides amazing new expressive possibilities for a musician, but requires a great deal of practice to play in tune, especially polyphonically. You must precisely place fingers for an in-tune performance. Not only must each finger be placed in the exact position at the beginning of each note; each finger must be in exact position after you perform glissandi and other finger movements. Finger positions must be accurate to a fraction of a millimeter (3 to 5 cents) to sound in tune. To aid the player with this positioning, there are Note Markings on the playing surface, and the ability to round finger positions to a Tuning Grid. The following sections will describe the note markings and Tuning Grids; also see Section 1.10 for a discussion of Round Rate and Round Initial.

### 8.1 Note Markings

To aid the player in playing in-tune, the Continuum has a patterned playing surface. This surface has markings which represent a 12 division octave. Any tuning may be played (if Rounding is turned off) by placing fingers relative to these markings.

## Note Markings

Note markings along with equivalent musical note names and surface position numbers on the Silk Screened Continuum surface.



## 8.2 Tuning Grid

The Continuum Fingerboard has a tuning grid system that employs two concepts. The first is the idea that any section of the left to right Surface Position of the Continuum can be mapped to any pitch, and the second is that these pitch references can be initially or subsequently rounded to the tuning grid. **Important:** The first idea can be used without the second; in other words, tuning grids can be used without rounding, to warp (stretch note spacing, etc) the surface without imposing any particular scale.

Precisely correct pitches correspond to certain finger positions. These fixed positions form a grid; the grid may be spaced evenly (as in equal-tempered tuning) or unevenly (for example as used by Just Intonation tunings). Esoteric and downright bizarre tunings and pitch-warping grids can be user specified.

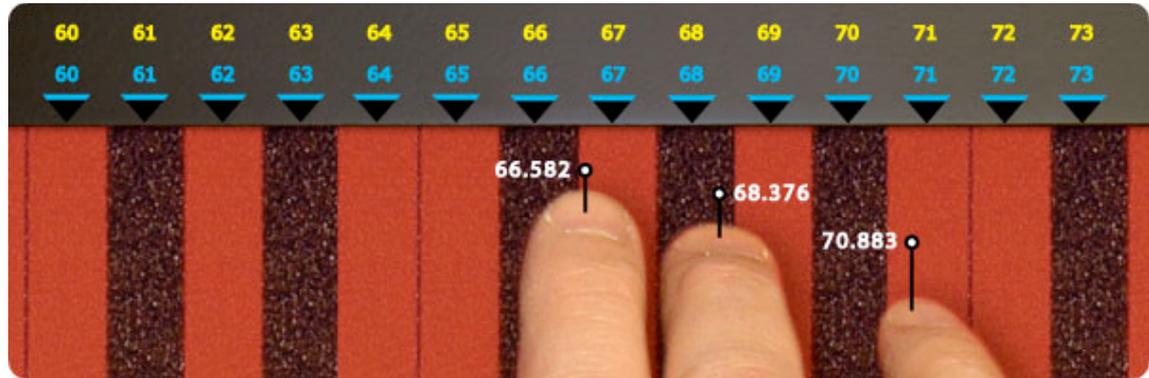
When a finger is placed on the playing surface, its pitch position is constantly calculated and can be expressed as the value of the pitch number for the associated surface position number. The fractional part of this number is the deviation from a standard Midi note pitch.

### Surface Position and Pitch

Each finger is numerically represented in white by the value of the blue pitch in relation to the yellow surface position. In this case (and whenever the tuning grid does not warp the surface) these blue pitch numbers and yellow surface position numbers have a one-to-one relationship.

## Surface Position and Pitch

Three fingers in contact with the Continuum surface. An equal tempered grid is shown. Each tuning grid point has a Surface Position (yellow) and corresponding Pitch (blue). If a tuning grid is defined such that the yellow and blue numbers do not align, the surface is warped, and number of cents per inch can vary across the surface.

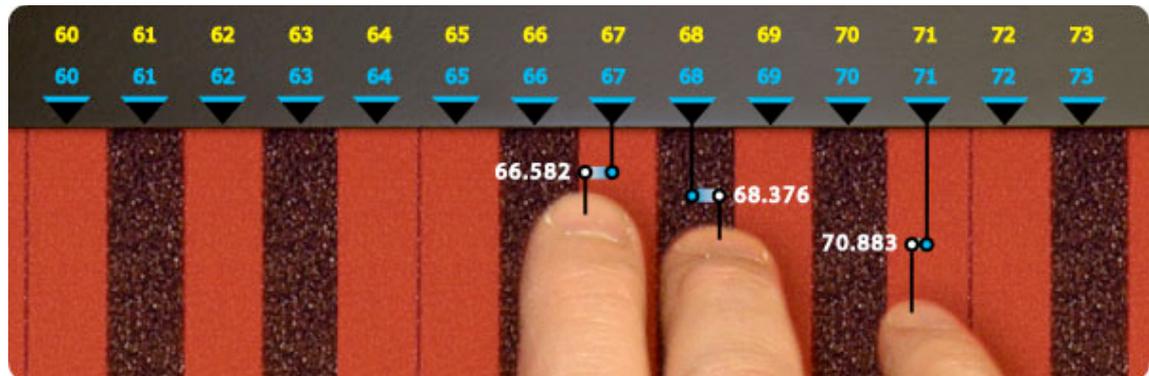


## 8.3 Equal Tempered Grid

Equal Tempered Grid is a standard grid where there is an even relationship between surface location and pitch position, and all rounding points are equally spaced. Note: Any tuning may be played (if Rounding is disabled) by precise finger placement relative to the marked lines.

### Equal Tempered

The fingers in contact with the Continuum surface are mapped to a standard pitch reference (in yellow). If Rounding is activated then the finger pitches will be rounded to an equal tempered grid (shown in blue). The first note changes from 66.582 to 67 (G), the second to 68 (G#), and the third to 71 (B, or H).



## 8.4 Just Tuned Grid

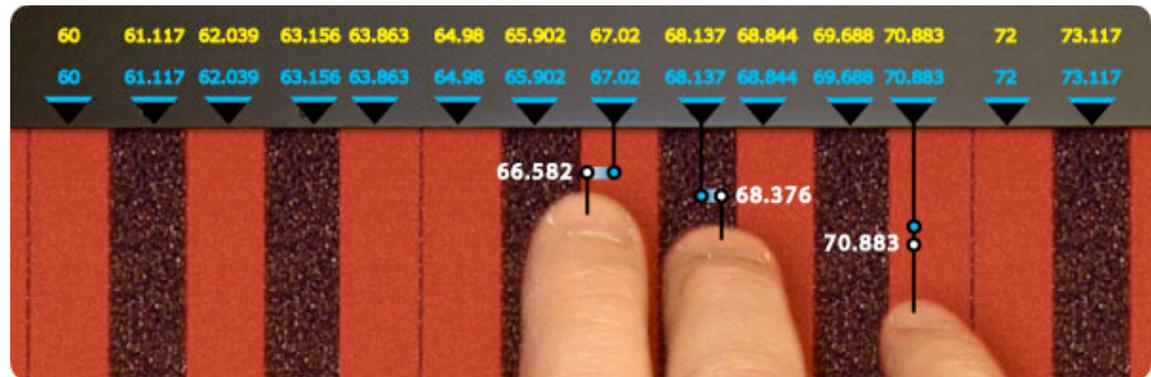
A predefined Just tuning scale is available on the Continuum, in twelve tonic centers. In this standard tuning there is an even relationship between location and pitch, but all rounding positions are not equally spaced, reflecting the numerical variances from a standard equal tempered 12 division octave.

In this Just tuning, any of the major triads (I, IV, V) will have perfect 4:5:6 frequency ratios in the rounded finger position, and the ii and vi minor triads will have perfect 10:12:15 frequency ratios. You can change the tonic key for the tuning at any time, even while fingers are pressing on the Continuum Fingerboard's playing surface; the Round Rate mechanism will correct the positions of those fingers to the new tuning.

**Important:** A skilled performer can play Just tuning (or any other tuning) without loading a tuning grid, simply by placing fingers correctly on the surface. This requires carefully developed playing technique and listening skills. The Just tuning grid is only needed if the performer is unable to place fingers accurately and is using "finger position rounding." Please see Section 1.10 for pros and cons of using finger position rounding.

### Just Tuned C Scale

*In this example, rounding is enabled. The fingers in contact with the Continuum surface are being rounded to a Just C Scale grid. The blue pitch points are the same values as the yellow surface positions, thereby preserving the linear progression of pitch values*



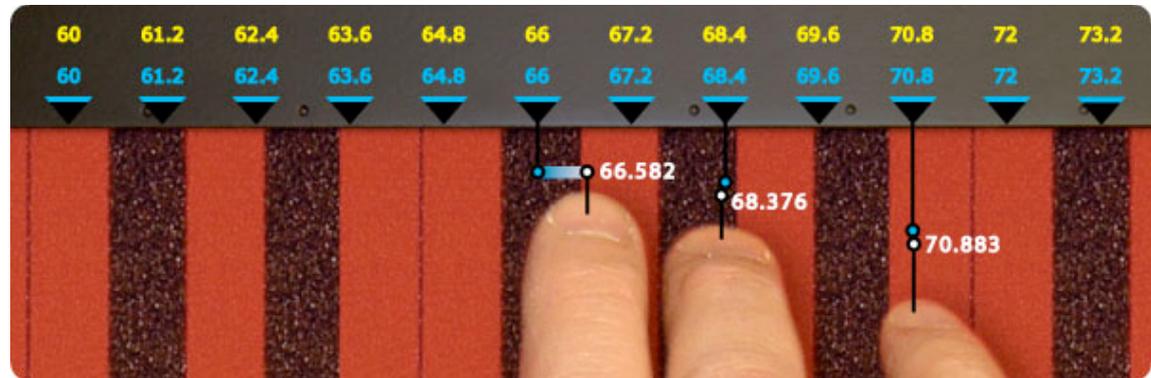
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## 8.5 Division of the Octave into "N" Parts Grid

In this alternate tuning there is an even relationship between location and pitch, and all rounding positions are equally spaced, reflecting the division of each octave into "N" equal parts. The normal octave can be divided into anywhere from 1 to 50 equal parts. For instance quarter tone music uses a division of 24. This tuning grid is intended for use with the finger position rounding mechanism (Section 1.10).

### Ten Note Octave

*In this example, rounding is enabled. The fingers in contact with the Continuum surface are being rounded to a 10 note octave grid. The blue pitch points are the same values as the yellow surface positions, thereby preserving the linear progression of pitch values.*



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## 8.6 Custom Tuning Grids

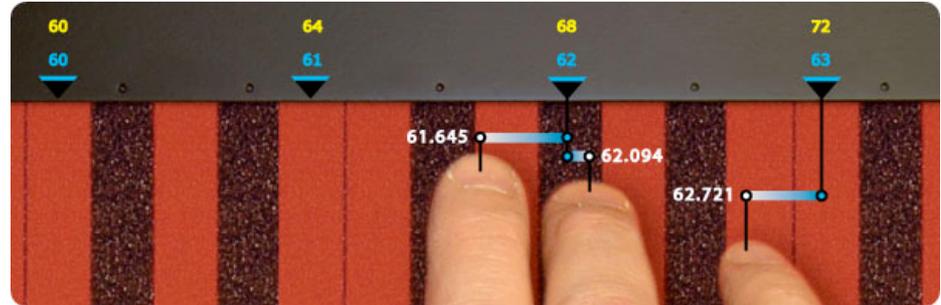
The Continuum Fingerboard has 8 user-definable downloadable tuning grids. The grid points in a tuning are used for Round Initial Pitches, for Round Rate, and for nonuniform pitch-warping of the playing surface without any rounding. Each grid point is defined by two numbers: a position on the surface (specified by equal tempered note number with fractional value, shown in yellow), and the pitch for that position (specified by note number with fractional value, shown in blue). For most tunings, the pitch matches the position at each grid point; if not, the surface will be warped and the number of cents per inch can vary across the surface. These tuning grids can be created by using the tuning downloader in the Download Resources area at the Haken Audio website.

## 8.7 Custom Tuning Grid Examples

Below are three examples of possible tuning grids. In each example only about one octave of surface position values are shown. For these examples it is assumed that the pattern of the surface to pitch mapping will continue above and below the surface ranges shown. In reality, this does not have to be the case. All three examples could be combined into one custom tuning grid, each example in a different Continuum surface position area.

### Example 1 - Stretched Note Spacing

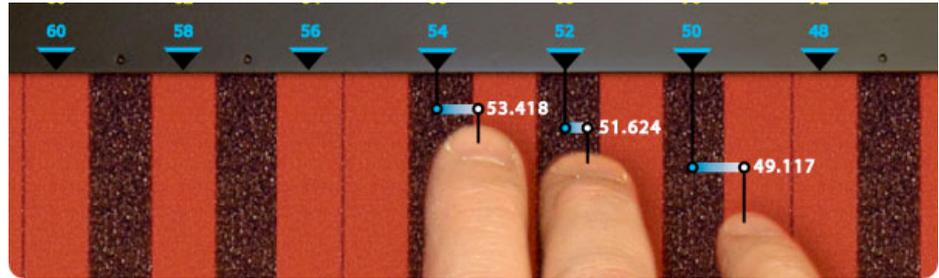
*An example of using the pitch processing of the Continuum for something other than rounding purposes. The fingers in contact with the Continuum surface are playing on a stretched tuned surface, so that four octaves of playing surface in yellow is equivalent to one octave of pitch change in blue. This type of tuning would be useful in exploring microtonal pitch clusters, where adjacent notes need to be something less than a semitone apart. Note that if rounding were engaged, the lower two notes would resolve with rounding to the same tuning pitch value, 62.*



### Example 2 - Reversed Whole Tone



The fingers in contact with the Continuum surface will be playing reversed blue pitches, centered around middle C (60). As well, the grid spacing is in whole tones (2 semitones), so that if rounding is engaged notes will round to the nearest whole step grid point.



### Example 3 - F# Major Just Triads

The fingers in contact with the Continuum surface are being rounded to a Just Tuned scale with an F# tonic center, however only major triad points (F#, A#, C#) are being used. If rounding is engaged, all notes will round to one of these values in each octave.

