Continuum Fingerboard User's Guide

June 20, 2017

Firmware Version 8.50

Edmund Eagan and Lippold Haken

About this document

The current version of this document can be found online in the Resources section of www.HakenAudio.com. We suggest new Continuum Fingerboard owners read this guide at least up to Section 10. 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.

Continuum Fingerboard, Continuum, Haken Continuum, Haken, and EaganMatrix are trademarks (TM) of Haken Audio. Eagan Instruments, Eagan Sounds, and Eagan are trademarks (TM) of Edmund Eagan. All other trademarks are property of their respective owners.

IMPORTANT!

The analog audio output of the Continuum is a TRS stereo (unbalanced) connection. DO NOT use a mono 1/4" audio cable to connect to this output. Damage to the analog circuitry can be caused by doing this for an extended time period. Refer to the hook up diagrams in Section 12 for proper Continuum Fingerboard connections.

Table of Contents

1. Overview of the Continuum Fingerboard

1.1. The Playing Surface

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 electronic or 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 the ability to create user-defined sounds. Stereo output from the internal synthesizer can be heard through the high quality analog output (stereo line level and headphone level) as well as the AES digital audio outputs.

The Continuum Editor application (for Mac and Windows), connects to the Continuum Fingerboard via Midi. The Continuum Fingerboard performance data can control external synthesizers via Midi, or analog modular synths via the Continuum Voltage Converter.

1.2. The 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.

1.3. What Sets the Continuum Fingerboard Apart

The Continuum Fingerboard has been under development since the 1980s, culminating in the Continuum Fingerboard with Light Action. In recent years, the idea of "Expressive Controllers" and "Expressive Midi" have been popularized, and many devices based on inexpensive sensing technologies have hit the market. As a result, there is much confusion of the capabilities of the Continuum Fingerboard compared to other "Expressive Controllers".

These are five key features of a Continuum Fingerboard with Light Action that set it apart from other "Expressive Controllers":

1. The Continuum Fingerboard has unparalleled temporal resolution. This means it has quick response to user actions. The Continuum Fingerboard hardware does a complete scan of all of its sensors several times per millisecond, and this is evident in the resulting sound when a skilled player performs well-designed presets.

2. The Continuum Fingerboard has unparalleled pressure resolution. The pressure resolution is up to 15 bits in long sustained notes, allowing tiny pressure-related timbre changes, and detailed pitch trajectories in pressure-weighted portamentos, not possible on any other electronic instrument.

3. The most important part of a note (from a psychoacoustic perspective) is the attack. On the Continuum Fingerboard, the detailed pressure trajectory of the finger is tracked and reported, and the details of the attack shape allows an experienced player to intricately control the sound in that all-important part of each note. Other "Expressive Controllers" encode the attack as a single 7-bit number, called the "strike value." This 7 bit "strike value" is used to trigger envelopes; the fine structure of the real attack is lost, and attack details are automated just as they are with Midi keyboards. In contrast to this single value, the Continuum evaluates a high speed stream of surface data which can effectively encode the complex trajectory of an attack.

4. On the Continuum Fingerboard, you can roll your finger slightly to create beats in intervals, or make the beats melt away. Precise pitch requires accuracies of position (centre of finger) of about 30 microns, or put another way, accuracies to 1/500th of a semitone. The Continuum Fingerboard alone makes it possible to play each note with this micro-tuned pitch accuracy from beginning to end. The Continuum Fingerboard alone allows for perfect fifths, perfect fourths, exact major thirds, etc (standard performance technique in acoustic string instruments and vocal choral ensembles) — exact finger placement allows a skilled performer to play all intervals in a piece with perfect frequency ratios, or slide in and out of perfect ratio during notes. We have become accustomed to the strictly quantized 12-pitches-per-octave music in the synth world, but any good singer, string player, woodwind player, etc adjusts each note's pitch to fit what is going on.

5. The EaganMatrix synthesizer developed for the Continuum Fingerboard is far beyond any other synthesizer in how it uses finger information to affect the sound. Other "Expressive Controllers" use standard synth designs with simple parameter mappings (both in their own device and in controlling other third party synths) but those cannot give the depth of interaction between the finger motion and the sonic result that is possible with the EaganMatrix. In acoustic instruments, performer's motions have a complicated effect on the timbre, and this is much of what makes an acoustic instrument interesting to listen to for many hours. Nobody would listen to a single synth patch for very long if there is no interesting fine-structure control, it gets boring quickly, and synths make up for this shortcoming by playing lots of different timbres. Other "Expressive Controllers" do not solve this problem as well as the Continuum Fingerboard does.

Conventional wisdom assumes fast live performance is not possible on a continuous pitch instrument like the Continuum Fingerboard, because it is too difficult to place fingers accurately quickly enough. This is incorrect; please see Section 3. Playing fast passages as well as playing slow passages expressively on a Continuum Fingerboard will require much practice. An acoustic instrument requires extensive skills and musicianship to create an expressive performance; it should be expected that the same is true for an electronic instrument. The Continuum Fingerboard should not be seen as a way to replace other instruments or to "make it easy" (thereby deskilling the musical performance process); the Continuum Fingerboard has been designed to give the skilled performer the depths of expression and capabilities found in a fine acoustic instrument.

2. Haken Audio Hardware

2.1. The Continuum Fingerboard

The Continuum Fingerboard has been under continual development since the 1980's. Early versions used many different sensing technologies.   By the 1990's experience showed that an electromechanical system involving magnetic technologies provided the most accurate way to track tiny movements of multiple fingers. By the early 2000's, the nylon-manufactured-into-neoprene over the electromechanical sensing system was found to give the best surface feel and consistent tactile feedback. Five years later, Continuum Fingerboards incorporated a custom-designed DSP board to scan the sensors, synthesize internal sounds, and do I/O.

In more recent years all Continuum Fingerboards incorporate a "Light Action" playing surface, made possible by a combination of state-of-the-art sensor technologies (super-sensitive Hall-effect sensors), as well as state-of-the-art precision-machined mechanical components, underneath the layer of neoprene. Continuum Fingerboards with "Classic Action" were already the most sensitive electronic instrument in existence. The "Light Action" playing surface has extended the Continuum Fingerboard's pressure sensitivity, pitch accuracy, and temporal resolution even further.

Since the middle of 2016, new Continuum Fingerboards are shipping as "L2x" (Light Action with a double-processing-power DSP), or as "L6x" (Light Action with CEE for a total of three double-processing-power DSPs). Other configurations are possible. What is in a particular Continuum Fingerboard can be identified by running the Continuum Editor and noting the System Identifier.

*This System Identifier, **L5x**, can be decoded as: **L**: Light Action, and **5x**: Total processing power.*
The 5x processing power reflects an addition of a Continuum EaganMatrix Expander (CEE) with two 2x DSPs to a Continuum Fingerboard with an internal 1x DSP.

Although not necessary for the enjoyment of working with the Continuum Fingerboard, it's DSP power can be enhanced as outlined in Section 2.2.

2.2. The Continuum EaganMatrix Expander (xCEE and iCEE)

The Continuum EaganMatrix Expander.
The external "xCEE" is pictured; an internal-to-Continuum "iCEE" is also available.

The Continuum Fingerboard contains a single Digital Signal Processor (DSP), which computes the internal sounds. Haken Audio's Continuum EaganMatrix Expander (CEE) provides two more DSPs for sound computations, thereby significantly increasing the polyphony of EaganMatrix presets. This increased polyphony is especially useful for EaganMatrix presets that require polyphony greater than the number of fingers simultaneously touching the surface, such as percussive sounds with releases that continue long after the finger is lifted from the playing surface.

Six different DSP system configurations are possible for a Continuum Fingerboard.   The Continuum Fingerboard's main DSP can be a 1x processor or a 2x processor.   An EaganMatrix Expander adds two more processors; these processors may also be 1x processors or 2x processors.   The chart below shows the resulting polyphony of an EaganMatrix Preset for each Light Action Continuum system configuration:

System ID	Continuum (DSP 1) Processor Type	CEE (DSP 2 and DSP 3) Processor Type	Total Polyphony As a Function of Base Polyphony							
			1	2	3	4	5	6	7	8
L1x	1x	No CEE	1	2	3	4	5	6	7	8
L2x	2x	No CEE	2	4	6	8	8	8	8	8
L3x	1x	1x + 1x	3	6	9	12	15	18	21	24
L4x	2x	1x + 1x	4	8	12	16	18	20	22	24
L5x	1x	2x + 2x	5	10	15	20	21	22	23	24
L6x	2x	2x + 2x	6	12	18	24	24	24	24	24

Polyphony Chart for EaganMatrix Presets.
For example, an L5x system would have a polyphony of 15 with a sound that had a Base Polyphony of 3.

Split, Sequential, and Layered Presets

In addition to polyphony expansion for a single preset, the CEE also provides the ability to have two or three *different* presets loaded simultaneously. The presets may be played with **Split**, or with **Sequential** advance to another preset (using a foot pedal) when notes from the previous preset are still held, or with **Layering** (Sections 8.9 and 10.12). While these multi-preset capabilities may seem important, the primary use of the CEE is to expand computation power for single preset; split and layering is much less important for most Continuum players than for Midi keyboard players, because the primary way to affect timbre on the Continuum is by changing playing style and not by changing presets.

iCEE and xCEE

The CEE is available in two forms: Internal to the Continuum Fingerboard (iCEE), or as an external rack-mountable unit (xCEE). The iCEE is convenient when playing gigs (less cabling!), but the xCEE is more versatile (it can be connected to any Continuum, and it provides a few additional connection possibilities).   From a sound-making standpoint, the iCEE and xCEE are identical.

Front and back views of the EaganMatrix Expander (xCEE).

When using the xCEE, analog audio output from all 3 DSPs is still through the Continuum's stereo audio (headphone) jack. The xCEE has many connectors, but most of them are not currently used. Two special situations are possible with the xCEE connectors:

(1) Normally, only one Continuum Voltage Converter (16 CV outputs) can be connected to a Continuum. Optionally, a second CVC (32 CV outputs total) can be connected to an xCEE (not possible with an iCEE). See Section 2.3 for more about the CVC.

(2) One or two Tri-Value Pedals may be plugged into an xCEE, in addition to two other pedals connected to the Continuum's pedal jacks. A Tri-Value pedal plugged into Control 3 will act as an Octave pedal. A Tri-Value pedal plugged into Control 4 will act as an Advance pedal.

For more information, please see the xCEE User's Guide available in the Resources area at www.HakenAudio.com.

2.3. The Continuum Voltage Converter (CVC)

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 EaganMatrix.

A total of 16 unique continuous voltage streams are available from a CVC.

The CVC may be used as a desktop device, or mounted in a standard 19 inch rack with optional rack ears.

For more information, please see the CVC User's Guide available in the Resources area at www.HakenAudio.com.

3. Historical Context

Electronic music history can teach us about greater possibilities that are different from want current Midi instruments offer. Rather than discount historical instruments as "old", Haken Audio endeavours to revive lost skills and ideas, and build on them.

The two historical electronic music instruments most like the Continuum Fingerboard are the Ondes Martenot and the Trautonium. Like the Continuum, both the Martenot and the Trautonium have continuous pitch capabilities, and both have pitches arranged horizontally with constant cents-per-inch spacing.

The Martenot can only play one pitch at a time when it is played in continuous-pitch mode. The Continuum extends this to polyphonic continuous-pitch playing. Unlike the Martenot, where the right hand controls pitch and the left controls articulation, on the Continuum each finger controls both pitch and articulation of a note.

The Trautonium has two monophonic continuous-pitch manuals, and the right and left hands can play simultaneously on each manual. The Continuum extends the Trautonium's dual polyphony to higher polyphony; on the Continuum each finger can play its own note on the super-sensitive multi-touch surface.

3.1. Touche

A Martenot player controlling amplitude with the left hand and continuous pitch with the right. The left hand is pressing the Martenot's Touche; the right hand is in front of the keyboard, moving the Martenot's ring for continuous pitch changes.

In certain performance situations, the Martenot's separation of right hand (pitch) and left hand (articulation) is advantageous. For such situations, the Continuum supplies "Touche" capabilities. The Touche on the Continuum is a small user-definable area on the surface set aside for left hand articulation control; the rest of the surface is for playing notes. The articulation for each note may be totally controlled by the Touche, or articulation may be controlled by a combination of the Touche and the fingers of the right hand. Since playing Continuum with Touche is very different from playing without Touche, sounds are specially designed for use with the Touche. A performer can use the Touche when playing polyphonically — the left hand affecting articulation for all the notes played with the right hand. The Continuum's Touche is more sophisticated than the Touche on the Ondes Martenot; the Continuum's Touche responds more quickly, is more accurate, and can control sound parameters in more complex ways. The Continuum Touche area can be placed anywhere on the Continuum surface, allowing for easy left or right handed control.
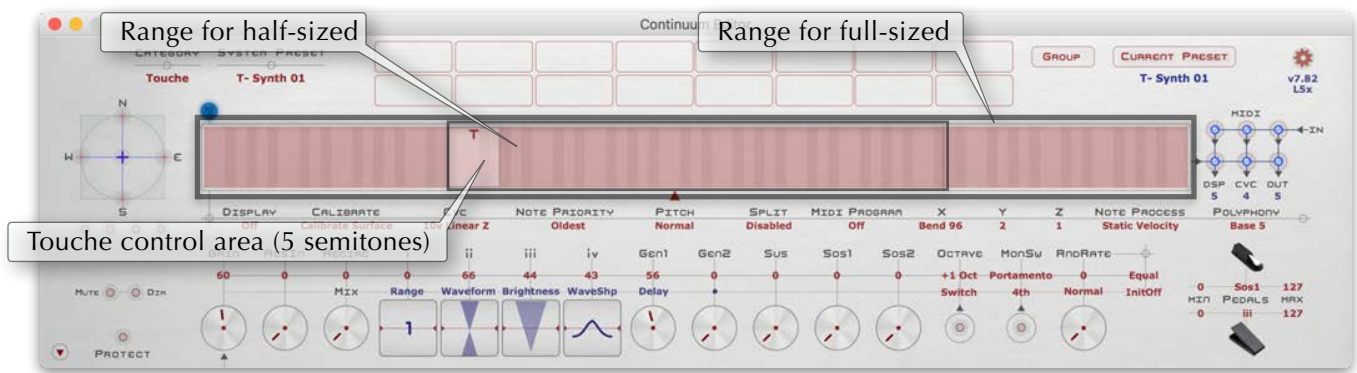
The Touche area on the Continuum, typically placed at the lowest end of a half sized pitch area.

3.2. Fast Continuous-Pitch Playing

The Trautonium pioneered fast duo-phonic playing in a continuous-pitch electronic environment. This is a challenge, because continuous-pitch instruments require accurate finger placement, and it is hard to place fingers accurately while playing fast passages that cover several octaves.

Oskar Sala overcame this problem, as you can hear in his magnificent Trautonium performance of Genzmer's Rondo in 1940 https://www.youtube.com/watch?v=8g_3UfPEpsY. This recording is largely forgotten, or erringly discounted as must-have-been-faked by people that know of it.

The Oskar Sala Mixtur-Trautonium,
played in the 1940 recording of Genzmer's Rondo.

The same techniques Oskar Sala used to play fast passages can be used on the Continuum Fingerboard, by a performer willing to practice extensively and attain advanced playing skills. Oskar Sala's technique is built on three ideas:
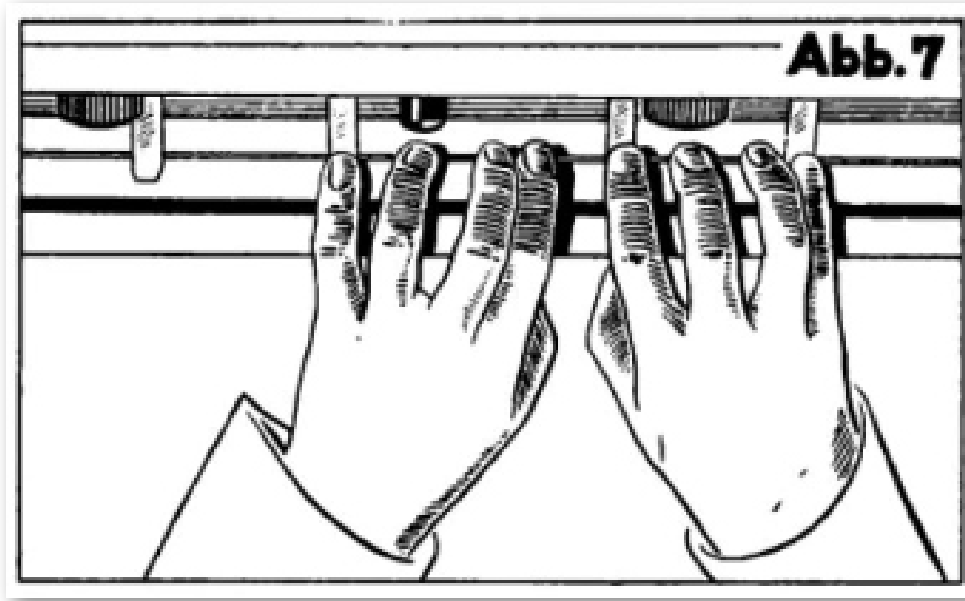
(1) The image above is from the 1933 Trautonium User's Guide (in German: "Trautoniumschule"). Notice how the fingers are positioned for a major scale; the left-hand pinky is on the tonic of the scale. This could be any major scale; all major scales have this same spacing between fingers. To change major scales, the hands only need to be moved left or right to a different tonic. Since 7 fingers are required for the 7 notes in an octave, this technique requires both hands to cover an octave (5 fingers will not suffice).

(2) The performer 'parks' fingers in position for the micro-tuned pitches of one octave, and can play any note in that octave without moving the hands. The hands stay in one position for the duration of the fast passage; only vertical finger movement is required to play each note in the passage. Octaves are switched with a Tri-Value pedal. The Tri-Value pedal has three positions: at rest, up one octave, and down one octave. The Continuum Fingerboard's Tri-Value pedal is a *custom-wired* Linemaster 476-S (please contact Haken Audio if you are interested!). The Continuum improves on the Trautonium by requiring much less vertical finger motion to play a note, much finer and faster articulation control, and higher polyphony — at the same time inheriting the Trautonium's capability of playing super-fast continuous-pitch passages.

The Continuum's Tri-Value Pedal, ideal for pitch shifting the Continuum surface up or down octaves.

(3) For uniform dynamics within the super-fast passage, use the "Legato TZ" mono mode (see Section 6.3).

4.   Midi Encoding

4.1. Encoding Principles of the Continuum Fingerboard

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 by using all 16 available Midi channels, 1-16.
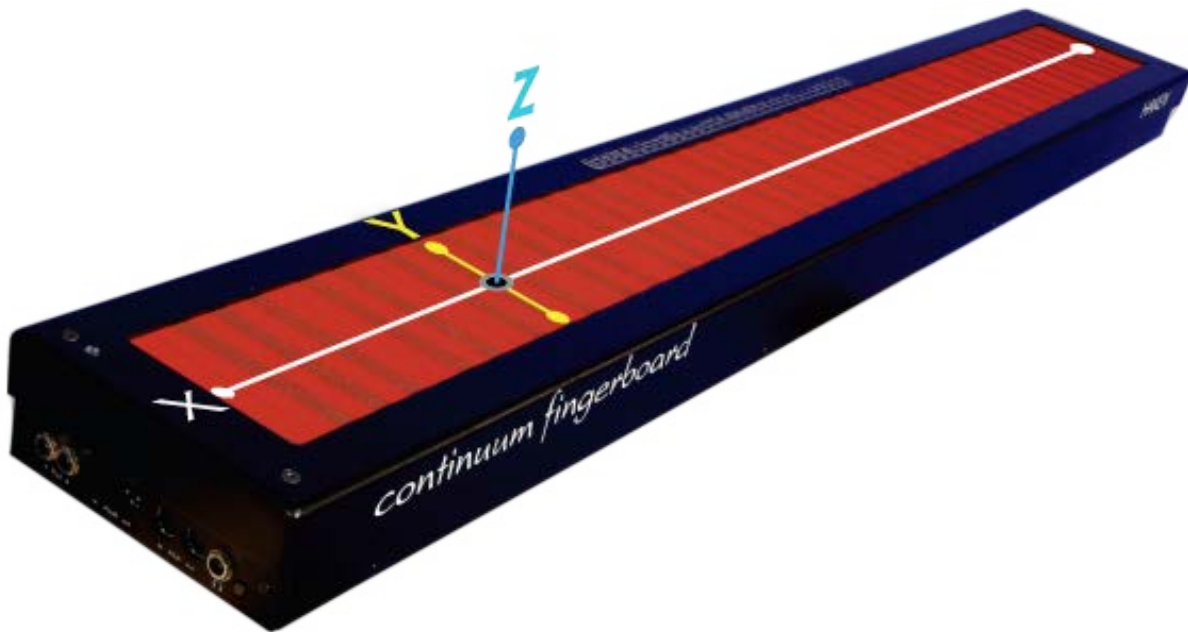
The Continuum Fingerboard tracks pitch (X), front-back position (Y), and pressure (Z) for each finger. The exact pitch of each finger is encoded as the nearest Midi note number to the initial position of the finger, plus the Pitch Bend on the finger's Midi channel. Note numbers range from 15 to 109 on 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 (Section 10.11) or a custom Pitch Table (Sections 6.4 and 10.16). The default Pitch Bend range is eight octaves. The default encoding for finger pressure uses Midi Channel Pressure, and the default encoding for front-to-back uses Midi controller 74 (Brightness).

The Continuum Fingerboard's Midi encoding can follow the "Multidimensional Polyphonic Expression" (MPE) standard. As per the MPE standard, the Continuum uses controller 127 on channel 1 to specify polyphony, RPN 0 on channel 2 to specify bend range, and channels 2 through P+1 for notes (P is the polyphony).

MPE is very similar, but not exactly the same as, the Continuum Fingerboard's encoding that dates from 2001. You can customize the Continuum Fingerboard's Midi encoding if you are controlling a synth that does not support MPE. For example, you might configure Z as Midi controller 11 (Expression) rather than Channel Pressure. Also, you can configure the Continuum to use 14-bit MPE encoding (Section 10.9).

Continuum Fingerboard configuration changes may be made three ways: using the Continuum Editor computer application (Section 8), using the Continuum Fingerboard's playing surface (Section 9), or by sending Midi configuration messages to the Continuum Fingerboard (Section 15).

4.2. Connecting an External Midi Synthesizer

In addition to playing internal sounds, you may want to connect your Continuum Fingerboard to an external Midi synthesizer. If your Midi synthesizer can do the "MPE" standard, simply load one of the MPE System Presets (in the "Midi" category of System Presets) in the Continuum, and set your Synthesizer to use MPE, and it should work. In practice, many synthesizers do not support MPE, and even those that do can be problematic because MPE is (as of this writing) a "standard" that is still being modified. This section will describe how to configure your Continuum without using MPE.

To play polyphonically, the externally connected synthesizer 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 extends 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.

Voice Number	X (left to right)	Y (front to back)	Z (pressure)
1	Midi Note and Pitch Bend on Channel 1	Midi cc74 on Channel 1	Midi cc11 on Channel 1
2	Midi Note and Pitch Bend on Channel 2	Midi cc74 on Channel 2	Midi cc11 on Channel 2
3	Midi Note and Pitch Bend on Channel 3	Midi cc74 on Channel 3	Midi cc11 on Channel 3
4	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 6.3.

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 (see Sections 12.9 and 12.14). 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 (Section 10.7).

Set the Continuum Fingerboard to send a Midi cc value for Z (Section 10.9) to something that will control an amplitude change in the external synthesizer, usually Midi cc11 or Midi cc07.

Set Y (Section 10.8) to a Midi cc value that typically 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 8.10 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:
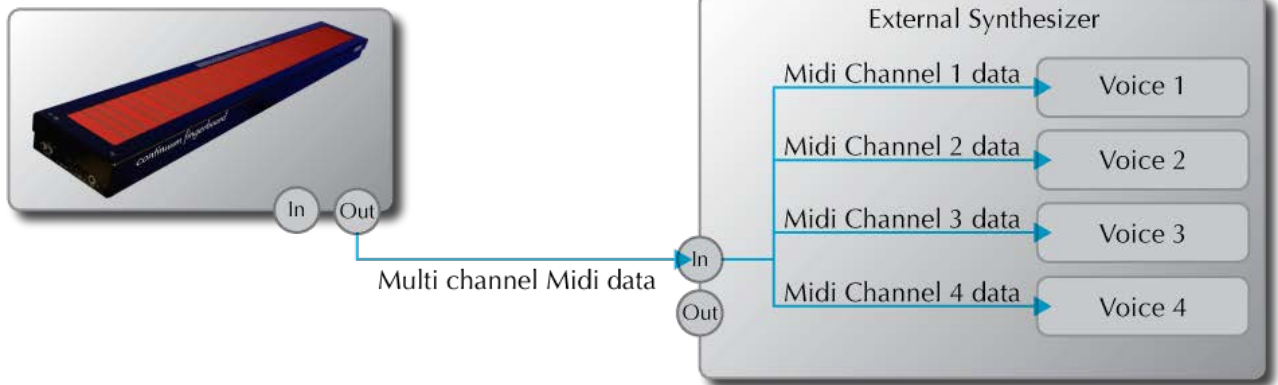
For wiring information and diagrams, refer to Sections 12.9 and 12.14 of this User Guide.

4.3. Specialized Kyma Encoding

KYMA 囧 X

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 a 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 may be 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 10.10 for required Kyma-specific configuration, and Sections 12.10 through 12.13 for connection diagrams.

5.   Specifications

5.1. Left and Right Panels

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. Normally dim blue. Changes colour depending on configuration state, via interaction through the Continuum Editor or the Red Button (9).
2	Pedal 1 input. Connect a standard passive switch, damper pedal, or passive continuous pedal; see Section 6.5 for pedal details.
3	Pedal 2 input. Connect a standard passive switch, damper pedal, or passive continuous pedal; see Section 6.5 for pedal details.
4	Digital audio input (AES3 format), and a high-speed link from the Continuum EaganMatrix Expander (xCEE).
5	Digital audio output (AES3 format), and a high-speed link to the Continuum EaganMatrix Expander (xCEE).
6	Midi input.
7	Midi output and Continuum Voltage Converter (CVC) control output.
8	Analog audio out, headphone level. TRS Stereo jack.
9	The Red Button, used for configuration procedures when the Continuum Editor is not available.
	Right End of Continuum Fingerboard
10	Power plug (110/220v, 50-60hz)
11	Fuse (4 amp)
12	On/Off switch

For detailed connection diagrams showing how to interface the Continuum with the outside world visit Section 12 of this User Guide.

5.2. Hardware Specifications

	Full Size	Half Size
Pitch Range	Nearly 8 octaves (9350 cents)	Nearly 4 octaves (4610 cents)
Polyphony	Internal control of synthesizer maximum 32, external Midi maximum 16	
Pitch Resolution	Better than 1 cent	
Scan Interval	330 microseconds	
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 Plastic Case	17 kg (38 lbs)	11.2 kg (25 lbs)
with Flight 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, audio out, 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	

6.   Operating the Continuum Fingerboard

6.1. Turning On the Continuum Fingerboard

The Continuum Fingerboard should be placed on a solid stand or table. The stand or table should not move appreciably 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.

When you plug in the Continuum Fingerboard and turn it on, the LED should light within a few 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, connect the supplied USB-Midi cable between your Continuum and your Mac or PC, and run the Continuum Editor (see Section 8 for setup details). Once the Editor is running, refine the surface calibration (see Section 7).

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 8 and 10.1 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 stereo line level output. (Never plug a mono cable directly into the headphone jack; that would short one channel to ground and potentially damage the headphone circuit.)

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.

6.2. 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 associated with the speed of the key movement.

In contrast, the Continuum Fingerboard is both velocity sensitive and, more importantly, pressure sensitive. It continually outputs a stream of pressure values. (A continuous stream of velocity values can be derived from the pressure values, since velocity is pressure-change-over-time.) The pressure values continue whenever 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 relatively 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 favourite 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.

A finger's initial contact with the surface is especially important. As with acoustic instruments, your Continuum Fingerboard allows you to shape the first milliseconds of a sound — much more detailed and varied control than provided by other electronic instruments. Much of the skill of an advanced Continuum Fingerboard player involves shaping the fine structure of attacks of sounds.

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.

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 use custom Pitch Tables to stretch half steps or repeat surface pitches (Section 6.4).

6.3. Mono (Multiple Fingers Combined Create a Single Note)

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 latter can be done a variety of ways on the Continuum Fingerboard — using the Touche (Section 3.1), using Lowest Channel Number (abbreviated LCN, Section 10.6) with a custom-programmed EaganMatrix, or, most commonly, using "Mono." Mono is a powerful performance feature unique to the Continuum Fingerboard. It can be used for playing single-note lines with articulation reminiscent of wind instruments, for oscillating back and forth accurately between two pitch centres, for whammy-bar effects, for piano-style glissandi (when used with Round Rate 127, Section 10.15), or for special trills, turns, and other ornamental effects.

Mono Functions

The Continuum Fingerboard supplies nine Mono Functions that allow you to process the combination of multiple fingers different ways. For the description below, we will assume Mono is being used to perform single-note lines with a variety of transitions between notes. If one finger is down, and another is pressed, Mono can convert this into two consecutive single notes with one of the following transitions between the notes:

Mono Function	Details	Midi Encoding
Portamento	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, based on the relative pressure of the two fingers.	A highly optimized series of Pitch Bend messages will be used to glide the pitch to the new note.
Legato Z	The second note sounds when the pressure of the second finger exceeds the pressure of the first finger. 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.
Retrigger Z	The second note sounds when the pressure of the second finger exceeds the pressure of the first finger. 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.
Legato T	The second note sounds as soon as the second finger touches the surface. 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.
Retrig T	The second note sounds as soon as the second finger touches the surface. 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.

Mono Function	Details	Midi Encoding
Retrig TL	The second note sounds as soon as the second finger touches the surface. 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.
Legato TZ	The second note sounds as soon as the second finger touches the surface. 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, and uses the max pressure of the two fingers.	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. The dynamics will be controlled by the highest pressure finger.
Retrig TZ	The second note sounds as soon as the second finger touches the surface. 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, and uses the max pressure of the two fingers.	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. The dynamics will be based on the highest pressure finger.
Retrig TLZ	The second note sounds as soon as the second finger touches the surface. 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, and uses the max pressure of the two fingers.	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. The dynamics will be based on the highest pressure finger.

Fingers 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, Retrig T, Retrig TL: 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.

Legato TZ, Retrig TZ, Retrig TLZ: 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. The dynamics are based on the highest pressure finger.

Activating Mono Functionality

Mono is active 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.

6.4. Rounding, Pitch Tables, and the Pitch Table Editor

Rounding

The Continuum Fingerboard includes a sophisticated mechanism to quantize finger positions to predetermined scale grids ("Pitch Tables"), such as Equally Tempered or Just tunings. 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 currently active Pitch Table, anywhere from instantaneous to glacial (minutes long). 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 (Section 10.15) using the Continuum Editor or the Configuration Strip. You can also change the Round Rate using pedals or Midi In (see Section 14).

Pitch Table

The Continuum Fingerboard allows you to choose Pitch Tables for Just tuning, equal tuning, N Division tuning, and user-defined custom Pitch Tables 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.

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 harmonic 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. The exception would be in playing a preset that has a pitch centre that is indeterminate, like an ensemble of strings or voices.

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.

Rounding via Y Position

Rounding via Y Position allows a variable amount of finger position correction, depending on the front-to-back placement of a finger on the surface. If the loaded preset does not use Y for timbral control, Rounding via Y Position can be a convenient way to use finger position correction as-needed for certain notes in a performance. During practice sessions, Rounding via Y Position provides an convenient way to rely less and less on rounding: as a player's proficiency at placing fingers accurately improves, the player can gradually change Y position to reduce automatic finger position correction. See Section 10.14 for details.

Pitch Table Editor: Simple and Radical Uses

A graphical Pitch Table Editor (PTE) and its User Guide are available in the Cogwheel menu (Section 10.22). The PTE is for creating custom downloadable Pitch Tables, and was written by Continuum Fingerboard player Pablo De La Loza. The PTE can be used for creating Pitch Tables for use with Rounding, or for radically pitch-warping the playing surface. For example, the PTE allows you to define Pitch Tables that stretch or shrink the size of octaves, or repeat or reverse the same pitches at different points on the surface.

6.5. 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 (see Section 14), except the pedal jack has higher precision.

Pedal Model	Output	Use
Yamaha FC7	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 and/or reversed, using the Continuum Editor's Pedal Min/Max settings (Section 10.18). The EaganMatrix 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 (used by many of the EaganMatrix system presets as Pedal 2).
Yamaha FC3	Continuous data values from 0 to 127. This range can be reduced and/or reversed, using the Continuum Editor's Pedal Min/Max settings. The EaganMatrix 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 (used by many of the EaganMatrix system presets as Pedal 1).
Yamaha 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.
Yamaha 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.
Linemaster 476S	Tri-Value pedal, a switch pedal *custom-wired* by Haken Audio, with three positions: at rest, heel, and toe. The corresponding values generated for each pedal position depend on the pedal's assigned function.	Ideal as an Octave pedal (Section 3) or as Advance pedal (Full Advance and Half Advance functions, Sections 8.9 and 14.3).

On the Continuum Fingerboard, Sustain and Sostenuto are continuous controls, allowing for fade and swell of sustained notes. Section 10.17 describes changing the pedal assignments for the jacks; a complete list of pedal assignment options is in Section 14.

6.6. Kenton Mini Controller and Kenton USB Midi Host
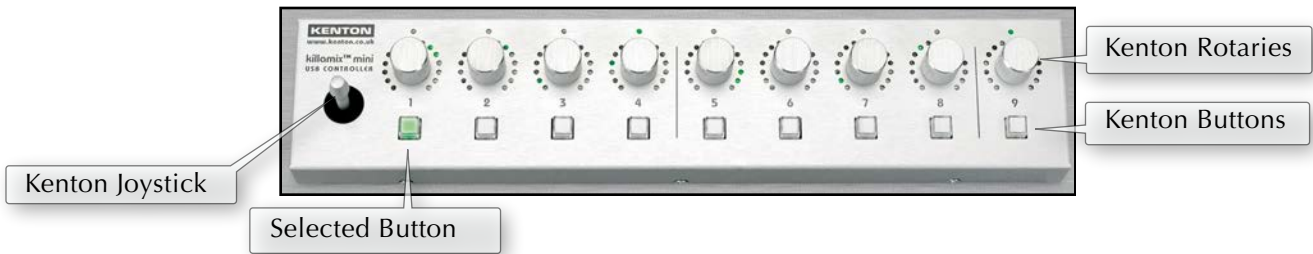
Kenton Mini USB Controller

The Kenton Mini Controller seamlessly integrates with the Continuum Fingerboard. http://www.kentonuk.com/products/items/midicontrol/kmix-mini.shtml 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 in the Continuum Editor are reflected by the Kenton's LEDs. The Kenton Settings option in the Editor's Cogwheel Menu (Section 10.22) allows you to customize Kenton functionality. The shortcut for the Kenton Settings window is Command+K (Control+K Windows).
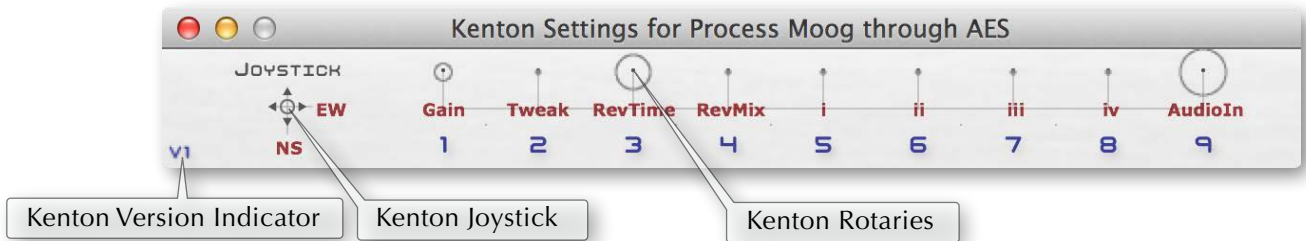
Kenton Mini Controller Window

Whenever the Kenton Mini Controller (or any controller for that matter) is used in conjunction with the Continuum Editor, the it'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..8 load from Internal User Preset Slots 1..8 (if Button 9 is unlit) or Internal User Preset Slot 9..16 (if Button 9 is lit). Button lights 1..8, together with Button light 9, always indicate which Internal User Preset Slot was most recently loaded.

Rotaries 1 through 9 are assignable in Kenton Settings, in the Cogwheel Menu. The rotaries are predefined with default assignments shown below.

Kenton default rotary assignments	
1	Gain level of the internal synthesizer

Kenton default rotary assignments	
2	Tweak mouseover Editor parameter
3	Internal Sound's recirculator R4 control ("time" control)
4	Internal Sound's recirculator mix control
5	Internal Sound Barrel i
6	Internal Sound Barrel ii
7	Internal Sound Barrel iii
8	Internal Sound Barrel iv
9	Audio In level of the AES3 digital input

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 System Preset is selected. 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 Mini 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.
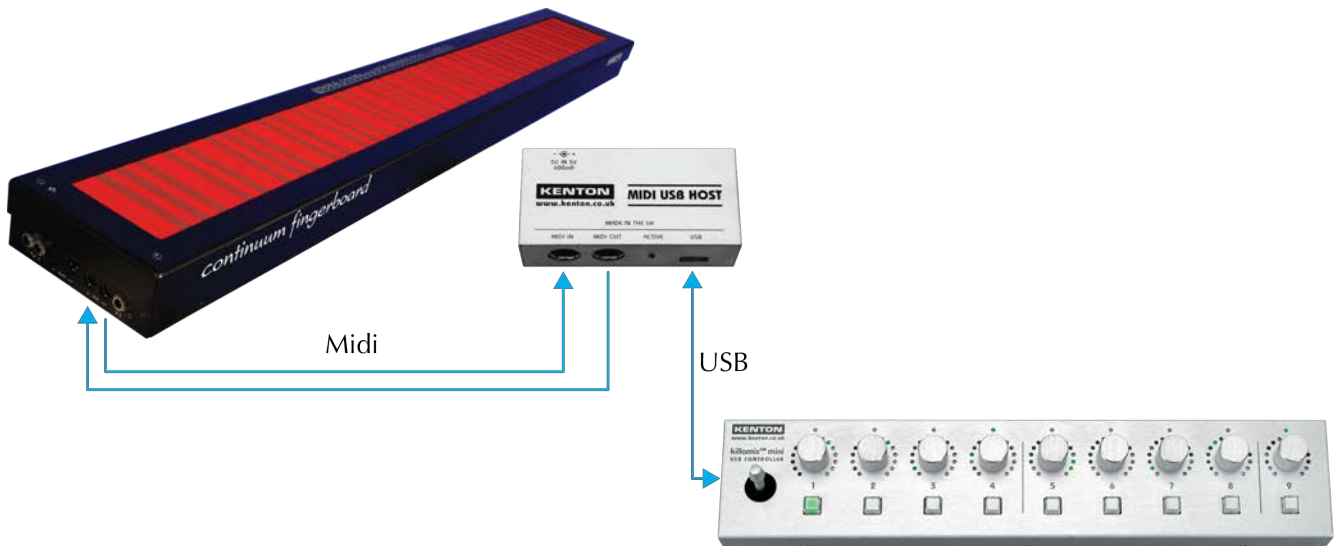

Kenton Mini Controller together with a Kenton USB Midi Host, without need of a computer
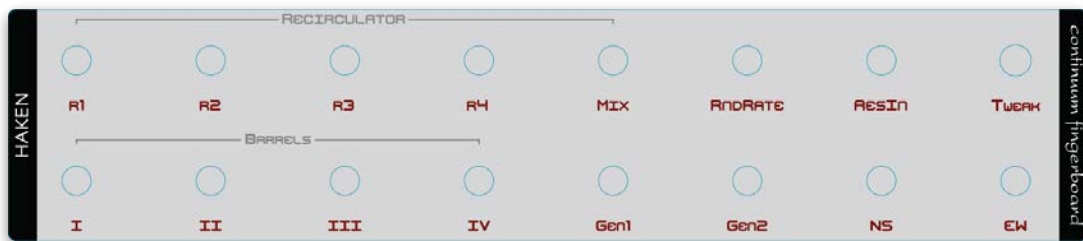
See Sections 12.15 and 12.16 for connection diagrams for the Continuum Fingerboard and the Kenton Mini Controller, with and without the Editor.

Page 30

6.7. Arturia BeatStep

The Arturia BeatStep (https://www.arturia.com/beatstep/overview) seamlessly integrates with the Continuum Fingerboard. The BeatStep provides physical buttons for loading presets from the Continuum Fingerboard's Internal User Preset Slots, and it also provides physical knobs for configuration parameters and pedal values, allowing precise setting of parameters. Each of it's endless rotary knob controls values in a relative mode – twisting to the right increases the parameter value, and twisting to the left decreases the parameter value. When the BeatStep is used in conjunction with the Continuum Editor, changes made via the BeatStep will also be updated on the Continuum Editor's screen.
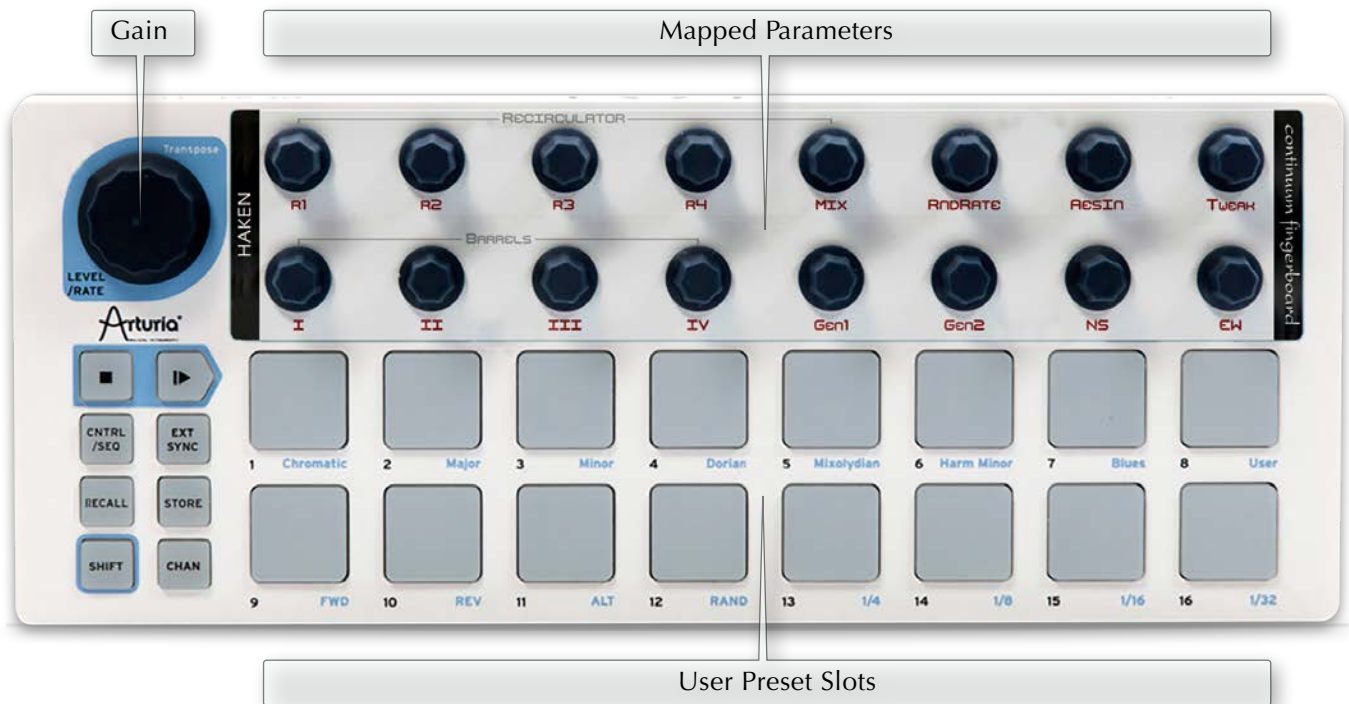
Haken Audio provides a configuration file for the BeatStep (in the Third Party folder). When this configuration file is loaded into the BeatStep, each knob is has a standard function for use with the Continuum Fingerboard. Haken Audio can provide a plastic overlay for the BeatStep that indicates the function of each BeatStep knob for the Continuum Fingerboard.

Continuum Overlay for the BeatStep

The BeatStep and the Kenton have some similar functionality, but unlike the Kenton, the BeatStep does not have two-way communication with the Continuum Fingerboard. On the other hand, the Arturia BeatStep has the advantage that it is much less expensive, and it is simpler to hook up in a standalone situation – the BeatStep comes with a TRS Mini to Midi Din cable to connect between it and the Continuum Fingerboard's Midi In.

See Sections 12.17 and 12.18 for connection diagrams for the Continuum Fingerboard and the Arturia BeatStep, with and without the Editor.

6.8. Anckorage Continuum Remote and Continuum Kiosk

The **Continuum Remote** is an iPad and iPhone interface for loading presets from the Continuum Fingerboard's Internal User Preset Slots, and loading system-defined internal sounds. The Continuum Remote includes graphic readout and touch-based control for sound parameters and pedal values. Unlike the Continuum Editor, the Continuum Remote does not provide EaganMatrix editing capabilities. The Continuum Remote is intended for use in situations where an iPad or iPhone is more convenient than a laptop, and sound editing capabilities are not required.

The Continuum Remote is part of **Anckorage's SpringSound App**, a spring-based physical modeling synthesizer, available for iPad and iPhone through Apple's App Store. The app is designed and programmed by Christophe Duquesne.

The **Continuum Kiosk** (not pictured here) is designed for public Continuum Fingerboard demonstrations. Visitors can use the Kiosk to select from 16 demo timbres, and try them out the Continuum Fingerboard. The Kiosk does not allow any configuration changes, so visitors using the Kiosk require minimal oversight. The Continuum Kiosk is also part of Anckorage's SpringSound app. (The same selection of demo sounds is available in the Continuum Editor's Group menu.)
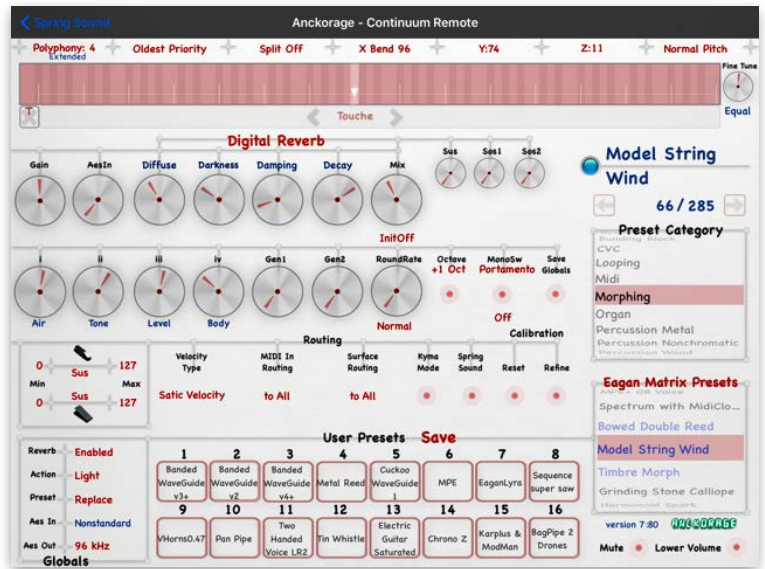
7.   Calibration

Before playing the Continuum Fingerboard for the first time, and each time it is transported it to a new location, it is important to refine its calibration. A refined calibration avoids "stuck notes". Calibration results are stored in the Continuum Fingerboard's permanent memory, so it is not necessary to refine calibration every time you turn it on. Refine calibration using the Continuum Editor (see Section 8) or the Overlay Strip (see Section 9).

Refining Calibration using the Continuum Editor

> Make certain nothing is pressing on the Continuum Fingerboard (no fingers or other objects on the playing surface or frame), then click on the Calibrate Surface menu and choose Refine.

Refining Calibration using the Overlay Strip

> Make certain 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 "1". Release that spot; your calibration has been refined.

Discarding Calibration

This discards all previous calibration data. Discarding the calibration can make the playing surface too responsive, resulting in stuck notes. You can expect stuck notes to occur during the first hour of playing after discarding calibration; it will be necessary to refine calibration (see above) whenever you get stuck notes.

Using the Continuum Editor: Click on the Calibrate Surface menu then choose Discard.

Using the Overlay Strip: Press and release the Red Button, then touch at "Calibrate", then touch at "0".

Light Action

Continuum Fingerboards built after 2012 are capable of Light Action (the default setting), responding to lighter finger pressure than the Medium or Classic Action. Light Action may be selected in the Continuum Editor's "Midi and Global Settings" (in the Cogwheel menu, or shortcut Command+G, Control+G Windows).

Help is Available

If you cannot get a good calibration, please contact Haken Audio for help. A good calibration is vital to a good Continuum Fingerboard playing experience.

8. Introduction to the Continuum Editor

The Continuum Editor is an application by Edmund Eagan and Lippold Haken, available for both Mac and PC from the Haken Audio website (Resources area). Most interaction with the Continuum Editor comes from one expandable interface window, shown above. In addition to replicating the functionality of the Overlay Strip (Section 9), the Editor can also be used to save presets in your computer's file system, and open them later (Section 8.5), and to load new firmware into the Continuum Fingerboard (Section 11). 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 and will not function correctly when moved outside the Continuum Editor folder.

Simple Midi cabling for the Continuum Editor:
This bidirectional communication allows the Continuum Fingerboard to interact with the Editor through a standard USB-Midi cable.
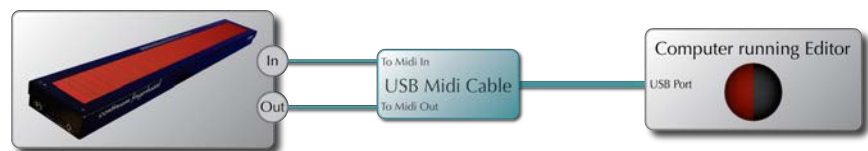
Use a USB-Midi cable to connect between your Mac or PC and your Continuum Fingerboard. Connect the USB-Midi cable's Out connector to the continuum's Midi In; connect the USB-Midi cable's In connector to the Continuum's Midi Out. The Continuum Editor automatically detects the iConnectivity Mio and the ESI Midimate2 USB-Midi cable, but other USB-Midi cables will also work, once you configure them in the Continuum Editor (see Section 8.1). For other connection examples, please see Section 12.

If you have trouble with your USB-Midi cable:
(1) Try resetting the USB-Midi cable by unplugging and replugging its USB connector.
(2) If you continue to have problems, try connecting your USB-Midi cable through a **powered USB hub**.

8.1. Setting up the Continuum Editor

When you run the Continuum Editor for the first time, make sure that you have the before-mentioned bidirectional Midi connection set up. 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 might be unconnected. To establish this connection, go to Midi and Global Settings in the cogwheel menu as shown below.
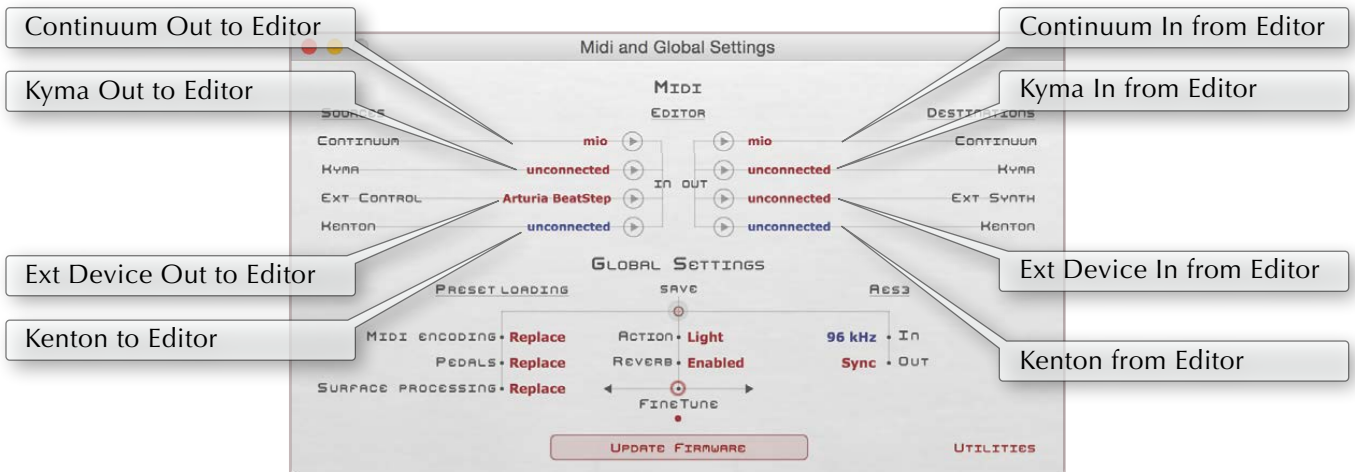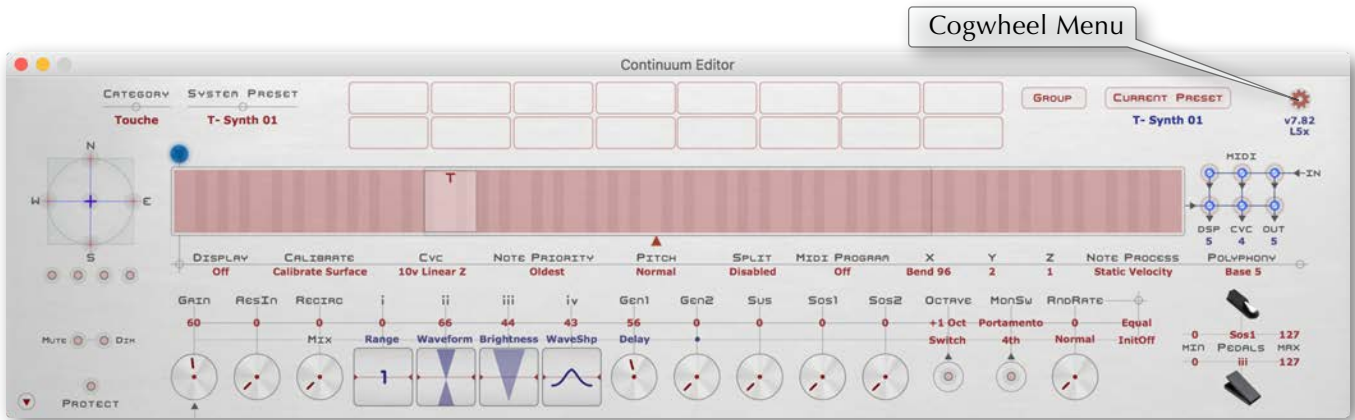
Midi and Global Settings (in the cogwheel menu).

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

The "Continuum" connections: Connections from/to the Continuum Fingerboard.

If you are using an iConnectivity Mio (or ESI MidiMate2) USB-Midi cable, your Continuum connections will be automatically detected. Otherwise, click on the popup menus to select your connections. Once the input and output connections for the Continuum Fingerboard are correctly made, the LED at the top-left of the main Editor window will change to from "off" to "blue".

If the LED does not change from "off" to "blue":
(1) Double-check your cable connections. The USB-Midi cable's "Out" should be plugged into the Continuum

Fingerboard's Midi In, and the USB-Midi cable's "In" should be plugged into the Continuum's Midi Out.

(2) Double-check your your popup selections in the Continuum Editor's "Midi and Global Settings".

(3) Try resetting the USB-Midi cable by unplugging and replugging its USB connector.

(4) If you continue to have problems, try connecting your USB-Midi cable through a **powered USB hub.**

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. (Also see Section 10.10 for a required Kyma-specific configuration option.)

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 do not have an external synthesizer, set the "ExtDevice" 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.

Examples

Please see Section 12 for examples showing connections to external hardware.

8.2. Using the Continuum Editor

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

Barrel (i,ii,iii,iv)	Barrels i, ii, iii, and iv are parameters for the currently loaded preset. Click and drag mouse vertically to desired value. Numerical value above each barrel will update as well.
Popup Numerical	Click once to activate popup, click on the desired value to make a selection.
Slider	Click and drag indicator to desired value.
Dial	Click and drag mouse vertically to desired value.
Toggle	Click to toggle value. Red around the toggle means "on", no red ring means "off".
Popup Menu	Click once to activate popup, click on the desired value to make a selection.
Led with Red Halo	Click to change. Shines blue for "on", dark for "off". (Here "Led" refers to small status indicators in the Editor.)

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. Arturia BeatStep, or another external Midi controller) will also be updated on the Continuum Editor's screen.

8.3. Continuum Editor Shortcuts

This list of keyboard shortcuts can be found inside the Cogwheel menu of the Continuum Editor.

Continuum Editor Shortcuts

Command Key (Mac) and Control + Shift (Windows) with...

l	Large Window (toggle visibility of Description and EaganMatrix)
g	Open Midi and Global Settings
k	Open Kenton Settings
b	Open Barrel Styles
o	Open Preset File
s	Save Preset File
x,c,v	Cut, Copy, Paste while editing Description
p	Open Max System Ports

Arrow Keys

Right	Increase Mouseover Value
Left	Decrease Mouseover Value

EaganMatrix with Selected Matrix Point

a..v	Set to User-defined Formula A..V
w..z	Set to Pre-defined Formula W..Z
1..9	Set to Constant 1..9
.	Set to Constant .0001 .. .9999 (type decimal point then up to four digits)
@	Set to Squared
#	Set to Cubed
Delete	Delete Matrix Point (disconnects row from column)
Escape	Deselect Matrix Point and Show Description

Pitch Trim (active while mouse is over surface display)

=	Add a pitch trim at current pitch and Y value
-	Delete a pitch trim at current pitch and Y value

Mouse Drag

|	
Barrels	Vertical Drag to Change Value
Dials	Vertical Drag to Change Value
Firmware	Drag-and-drop Firmware File onto UPDATE FIRMWARE
Preset	Open Preset File by dragging it onto CURRENT PRESET
	Drag-and-drop Preset File onto Internal User Preset Slots 1..16
Matrix	Drag Matrix Point to New Location (Alt+Drag to copy)
Group	Open Preset Group File by dragging it onto GROUP

The Shortcuts window from the Continuum Editor

8.4. Current Preset and Selecting System Presets

The "Current Preset" is the preset that sounds when you play on the surface. The Current Preset can be also be edited, saved to disk (Section 8.5), or stored to a User Preset Slot (Section 8.6).

System Presets in the Continuum Editor are organized into a number of categories, like Wind, Midi, Synth Pad, etc. To load one of the System Presets into the Current Preset, first select a Category, then select a System Preset within the Category:

1) Click on the red category name (under the word Category) to see a popup list of categories.

2) Double-click on a category in the list; a new popup listing System Presets in the category will appear.

3) Choose a System Preset in the list; it will load into the Current Preset.
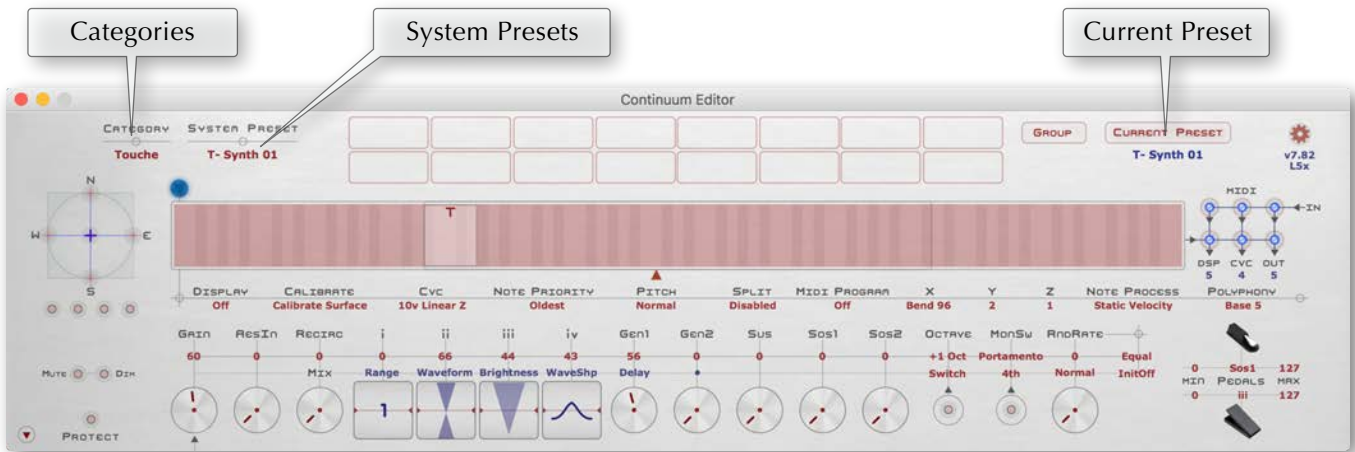
8.5. Open and Save User Presets in the Editor

Open from Disk

To open a Preset file on your Mac or PC, choose Open in the Current 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 Current 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.
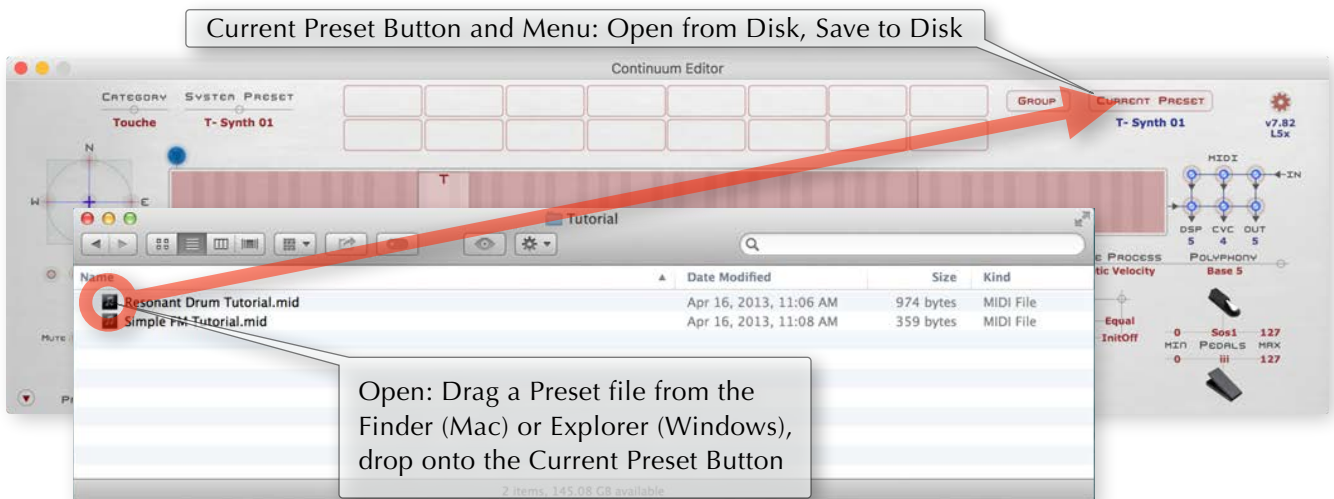
Save to Disk

To save a Preset file on your Mac or PC, choose Save in the Current 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.

8.6. User Preset Slots and Preset Groups

In addition to opening and saving Preset files on your computer, you can also load and store presets into the 16 Internal User Preset Slots inside your Continuum Fingerboard. It is usually preferable to save Preset files in your Computer's file system (Section 8.5), but when you do not have your computer connected to your Continuum Fingerboard and need access to custom user designed sounds, the Internal User Preset Slots give you access to 16 presets stored internally in your Continuum Fingerboard.

The 16 User Preset Slots. In this picture 5 User Presets Slots are in use, with User Preset Slot 5 currently selected.

To recall the a User Preset from a slot, simply click on the desired User Preset Slot.

User Preset Slot 2 has been recalled and is now the Current Preset.

To store the Current Preset into a User Preset Slot, shift-click on the target User Preset Slot.

Grinding Stone Calliope has been stored into User Preset slot 9.

It is also possible to drag and drop a .mid file directly into any of the 16 User Preset slots.

8.7. Open a Preset Group File

A "Preset Group" provides a convenient way to load a group of user presets into the User Preset Slots from your computer's file system. A Preset Group can have anywhere from 1 to 16 members. The members of a Preset Group load back into the same User Preset Slots they were saved from. All Preset Groups number from User Preset Slot 1. For instance, a Preset Group consisting of two presets will occupy User Preset Slot 1 and User Preset Slot 2, a Preset Group consisting of 5 presets will occupy User Preset Slots 1 through 5.

To open a Preset Group file on your Mac or PC, choose Open in the Group popup menu, or drag a Preset Group .txt 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 User 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. Normally, each Preset Group is in its own folder which contains the Preset Group .txt file as well as all the group member presets (.mid files).
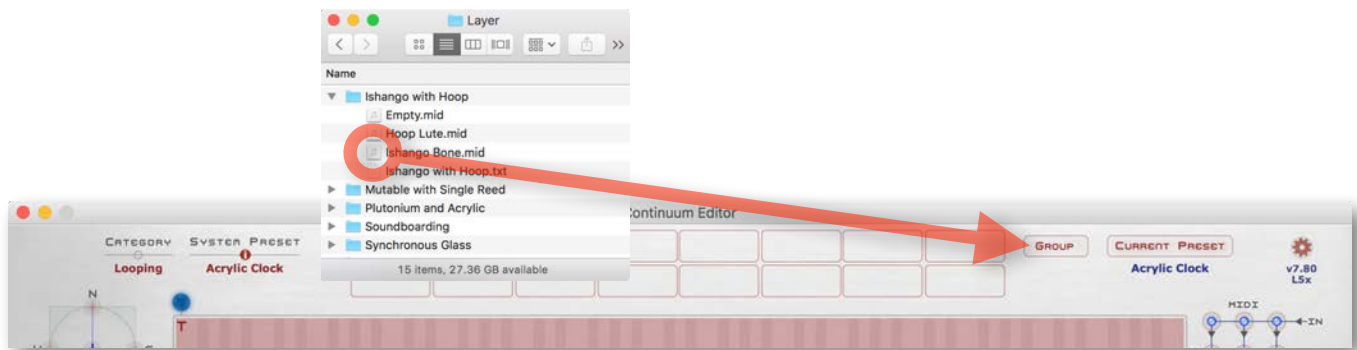
Drag-and-drop "Ishango with Hoop.txt" to load the 3 User Presets "Ishango Bone," "Hoop Lute," and "Empty" into User Preset Slots 1, 2 and 3. Note that in the computer's file system, all files are in the one folder named "Ishango with Hoop."

The folder containing the Preset Group can have any name. It does not need to match any of the names of the files inside the folder.

8.8. Save a Preset Group File

To save a Preset Group file onto your Mac or PC, 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 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). It is best to save each Preset Group is in its **own** folder; that folder will contain the Preset Group .txt file as well as all the group member presets (.mid files).

Highlighting User Preset 5 and choosing Save Group from the Group pop up menu will prompt the disk system for a location to store the Preset Group .txt as well as it's 5 User Presets from slots 5,4,3,2 and 1. The Save Dialog will also allow creation of a new folder for the Preset Group; it is best to save each Preset Group in its own folder.

To avoid accidentally overwriting your Preset Groups with a possible future firmware update it is best not to store the Preset Group folders in the Continuum Editor folder.

8.9. CEE Combination Presets

Combination Presets can *only* be used by Continuums expanded to three DSPs (see iCEE and xCEE in Section 2.2).

As of this firmware version, Combination Presets are in an early release stage, and will likely go through implementation changes in the future.

A Combination Preset in User Preset Slots 1, 2, and 3.

A Combination Preset consists of three presets. When the Combination Preset is loaded, the three presets are assigned to three DSPs, referred to as DSP 1, DSP 2, and DSP 3. There is one Preset for each of the three DSPs. A Combination Preset can be in one of four flavours, depending on the selection in the Split menu (Section 10.12):

Triple Layer: Each DSP is sonically layered; pressing a single finger plays all three presets at the same time. In the Split menu, split is disabled.

Split with Dual Layer: The Continuum surface is split so that one part of the split uses only DSP 1's preset, and the other part of the split layers DSP 2's preset and DSP 3's preset. In the Split menu, two variations are available: DSP 2 and DSP 3 used above the split point, or DSP 2 and DSP 3 used below the split point.

Split with Polyphony Expansion: This assumes DSP 1's and DSP 2's presets are different from each other, but DSP 2's preset and DSP 3's preset are identical. The Continuum surface is split so that one part of the split uses only DSP 1's preset, and the other part has increased polyphony by assigning different notes to DSP 2 and DSP 3. In the Split menu, two variations are available: polyphony expansion above the split, or polyphony expansion below the split point.

Sequential: Using a Half Advance pedal (Advance pedal with data 64, see Section 14.3), the DSPs can be sequentially switched so that the current playing preset can seamlessly change to a new preset without a sonic break. Notes held or sustained from the the previous preset continue to sound, and new notes will sound using the new preset. In the Split menu, the last option activates this mode. These Presets individually can still be used in a normal, single DSP Continuum, but cannot be seamlessly switched between as on an expanded DSP Continuum.

To create a Combination Preset, store three presets into three consecutive User Preset Slots. Then click on the first of the three, and checkmark "CEE Combination Preset" in the Group menu. The selected preset will be loaded onto DSP 1, its name will appear in italics (see image above), and whenever it is selected it will have a red border. The following User Preset Slot loads into DSP 2, and is indicated by a blue border. The third User Preset Slot loads into DSP 3, also indicated by a blue border.

When DSP 1 is selected (as in the image above), edits you make in the EaganMatrix only affect the DSP 1 preset, but you will also hear DSP 2 and DSP 3 when you play on the surface. After you make edits to the DSP 1 preset, you must shift-click on the User Preset Slot to save edits. (In this early release of Combination presets, you will lose edits unless you remember to do this!)

If you want to edit the DSP 2 or DSP 3 presets, first save any edits you made to the DSP 1 preset by shift-clicking on the DSP 1 User Preset Slot. Then click on DSP 2's or DSP 3's User Preset Slot. When you complete your edits, shift-click in the User Preset Slot to save your edits. To save edits for DSP 2 shift-click on the DSP 2 User Preset Slot. To save edits for DSP 3 shift-click on the DSP 3 User Preset Slot. Caveat: When using "Split with Polyphony Expansion", DSP 2 and DSP 3 should remain identical, so any edits to DSP 2 or DSP 3 should be saved back to both DSP 2 and DSP 3's User Preset Slot.

Use the Open Group (Section 8.7) and Save Group (Section 8.8) to open and save Combination Presets. Several example Combination Presets are available in the Group menu.

Important: A Combination Preset will get most of it's performance parameters from the DSP 1 preset. This includes settings such as transposition, mono interval, round rate, etc., ignoring the performance parameters that are stored in the Presets residing in DSP 2 and DSP 3.

8.10. Designing Sounds for the Continuum Fingerboard

The Continuum Fingerboard can be used to control a wide variety of sound synthesis algorithms. The System Presets, and User 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

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. Unless otherwise desired as a speciaized effect, 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.
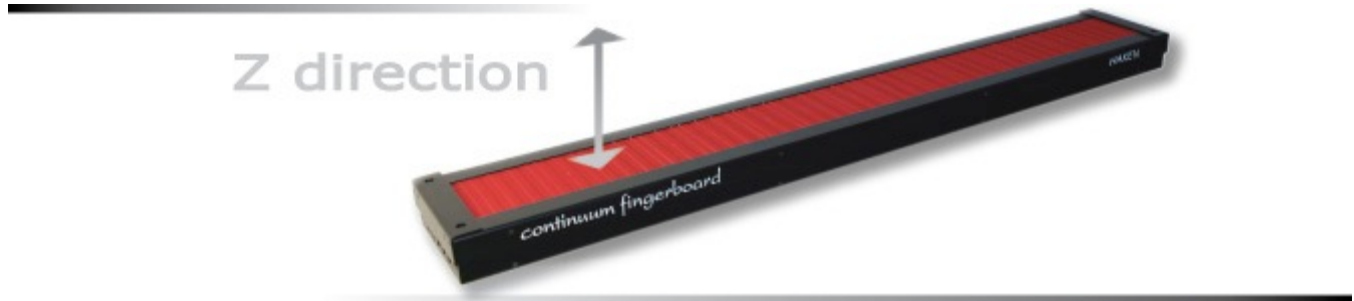
The Y Direction

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 System Presets 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 formulas employing different Y transfer functions.

The Z Direction

The Z direction of the Continuum Fingerboard is generally mapped to a loudness shift.
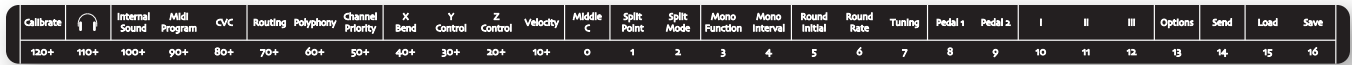
Use synthesis algorithms that have timbre changes associated with loudness changes. Some sampling synthesizers change only the volume as the performer's finger pressure changes during a note. This limits the apparent dynamic range and expressive possibilities available to the performer. With acoustic instruments, the timbre changes 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 rarely recommended. Key velocity (sometimes also called Strike in other "Expressive Controllers") is a single discrete value that is determined on the note's attack, and discards the fine structure of the attack. For musically interesting and expressive performance, a finger's initial contact with the surface is especially important. Much of the skill of an advanced Continuum Fingerboard player involves shaping the fine structure of attacks of sounds. For this reason the Continuum Fingerboard (like Midi breath controllers) defaults to transmitting a constant 127 for key velocity, and does all dynamic control (for attack and other parts of the sound) in a continuous fashion.

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.
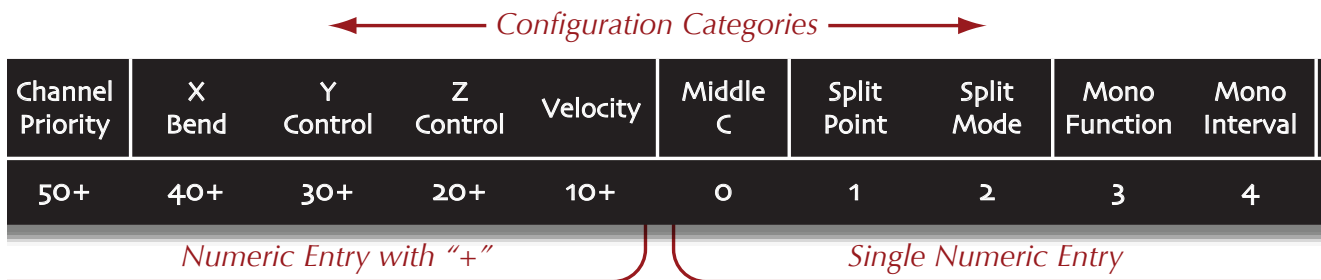
9. Introduction to the Overlay Strip

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

Numeric Entry with "+"   *Single Numeric Entry*

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:
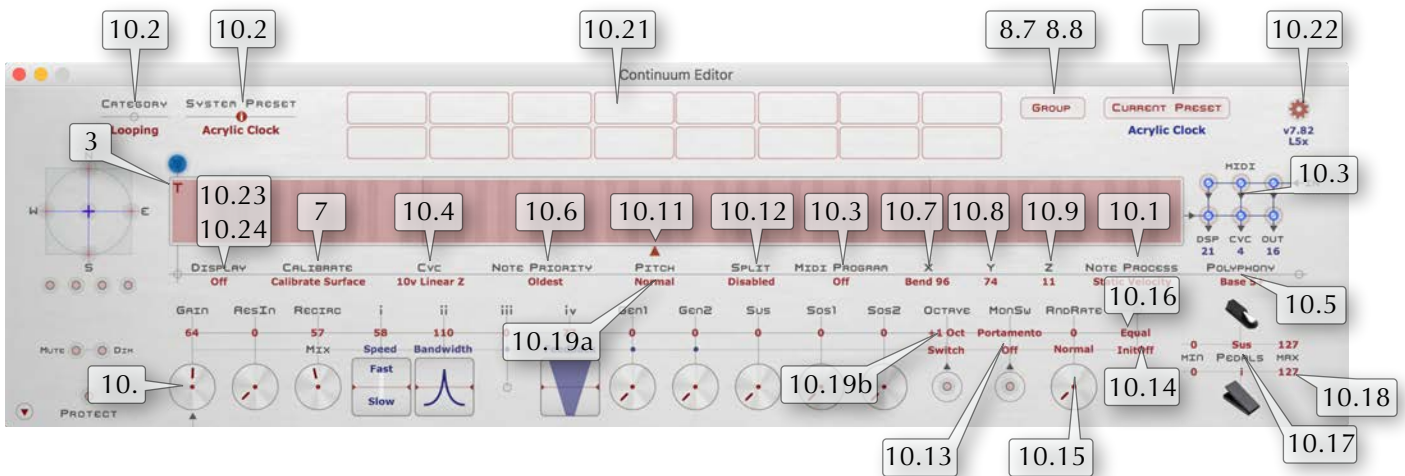
Start	The colour of the LED is dim blue during normal operation.	✴
Red Button	Press and release the Red Button next to the Headphone output on the side of the Continuum Fingerboard. The LED will turn from dim blue to bright red.	✴
Configuration Category	Touch the far edge of the Continuum Fingerboard surface at a configuration category. The LED will shine a brighter green while your finger is touching the surface, and return to a dim green after the touch.	✴
Numeric Entry	Touch the far edge (back) of the Continuum Fingerboard playing surface at 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 dim green when it is waiting for the second half of a dual numeric touch.	**single** ✴ **or dual** ✴✴✴
Configuration Changed	After the single numeric touch or the dual numeric touch the LED will go back to dim blue. The configuration has been changed.	✴

10. Configuration Options (via Continuum Editor and Overlay Strip)

Sections 10.1 to 10.24 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:

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

The legend below is labeled with numbers linking the Continuum Editor to the appropriate User Guide section. Refer back to this legend for most references throughout Section 10.

10.1. Gain

Gain	
0	Gain level off. Silence.
1 to 127	Level of the output from soft to loud. Excessively high gain may clip at high polyphony.
◉	The Gain is the last step in the signal chain, just before the Continuum Fingerboard's audio signal is converted from floating point to integer and sent to the Digital to Analog converters. Tip: Use low Gain values, together with high SL and SR values in the matrix, to introduce a soft saturation in the EaganMatrix.

10.2. Internal Sound (Load System Preset)

The Continuum Fingerboard's built-in synthesizer has hundreds of System Presets available.

To select a System Preset in the Editor: Choose a Category (click on the red category name, below the grey word "Category," to see the popup of categories). Then choose a System Preset within the Category (click on the red System Preset name, below the grey words "System Preset," to see the popup). For details see Section 8.4.

To select a System preset using the Overlay Strip: Use numeric touches that add up to the system preset number. For example, to select System Preset #171, press and release the Red Button, touch "Internal sound," touch 100+, touch 70+, touch 1. (Any combination of numeric touches adding up to 171 can be used.) The preset number of each System Preset in shown in the Editor's System Preset menu, and a complete listing of all system presets (with preset numbers) is available in the Editor's cogwheel menu.

System 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 an Arturia BeatStep, or using the Kenton Mini Controller, or a custom programmed Midi controller. They can be further modified using the EaganMatrix (see the EaganMatrix User Guide).

See Sections 8.4 through 8.8 for more information on loading and storing Presets, Preset Groups, and saving presets to your Mac or PC disk.

10.3. Midi Program, Midi Routing

Midi Program:
This will cause the Continuum Fingerboard to 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.

| Midi Program	
1 to 20	Sends the numeric Midi Program message on all active Midi channels.
0	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 from the playing surface:

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.

Routing	
⊙	More options are available in the Continuum Editor program, which uses a routing matrix, as explained below.
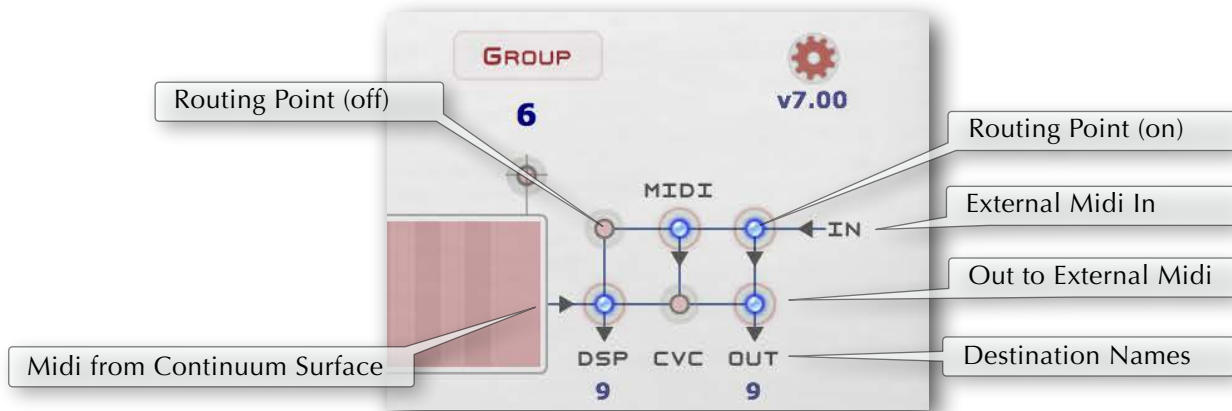
The Routing matrix of the Continuum Editor

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

10.4. CVC

Select standard CV definitions for the Continuum Voltage Converter (CVC), as described in the CVC User Guide (available in the Resources area of 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.

10.5. Polyphony

Polyphony	
1 to 16	Select base polyphony. Controls the maximum number of simultaneous output notes. The actual polyphony can be greater or smaller than the base polyphony you choose, due to split, mono interval, and other influences. When base polyphony is set to 16, certain Specialty Sounds can play at DSP polyphony 32. The CVC polyphony is limited by the number of CV outputs.
Allow Expanded Polyphony	Allows using increased polyphony on Continuums that have extra processing power. This affects Continuums with double-processing-power DSPs (2x processing power) and Continuum EaganMatrix Expanders (3x to 6x processing power, see System Identifier in Section 2.1.)

Polyphony	
Allow Increased Computation Rate	Doubles sample computation rate on Continuums that contain only 2x DSPs. This affects L2x and L6x Continuums. This should be used sparingly, since doubling the sample computation rate will reduce the number of voices that can be computed, and most EaganMatrix sounds do not benefit from a higher sample computation rate.
●	The Editor displays the actual polyphony for DSP, CVC, and Midi Out in blue under the Midi Routing matrix. Click on Polyphony to change the base polyphony.

10.6. Channel Priority

Fingers on the playing surface will generate output for Midi channels depending on the Polyphony and Split configuration. The order in which new notes from the playing surface are assigned to Midi channels can be Oldest (assign the new note to the Least Recently Used channel), Same (assign to channel that played the same pitch), or Lowest (assign to the lowest channel number that is available). The default is Oldest. The High 1 through High 4 settings are useful in directing which Midi channels are being currently used by the Continuum in overdub Midi performances.

Channel Priority		
0	Oldest	Assign to channel that was least recently used.
1	Same	Assign to channel that was playing same pitch.
2	Lowest	Assign to lowest channel number (LCN) that is not already playing a note.
3	High 1	Only highest channel of current polyphony is used. See explanation below.
4	High 2	Only highest two channels of current polyphony are used.
5	High 3	Only highest three channels of current polyphony are used.
6	High 4	Only highest four channels of current polyphony are 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 at 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 at 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 at 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.

10.7. X Bend

X Bend is the Midi pitch bend range that the Continuum Fingerboard uses to encode its Midi output. Set X Bend to the 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 1.2 cent encoding accuracy at a 96 half-step range, and 0.15 cent accuracy at a 12 half-step range.

X Bend	
1 to 96	Midi Pitch Bend range as expressed in half steps (default is 96).
◉	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.

10.8. 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).

Y Control	
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.

10.9. Z Control

The continuous controller number that Z (finger pressure) sends through the Midi output. The most common choices are: 127 for MPE encoding (channel pressure), or controller 7 for "channel volume" or controller 11 for "expression". In some synthesis situations 7-bit accuracy is not adequate for finger pressure; for these situations the Continuum Fingerboard can use 14-bit MPE Encoding.

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

Z Control	
70 (14-bit MPE)	14-Bit MPE Encoding: This is a variant of the MPE Encoding (see below), with 14 bits for Z and Y position. The most significant bits of Z are encoded with cc 70, the least significant use cc 102. The most significant bits of Y are encoded with cc 74, the least significant use cc 106. This added precision comes at a cost: it requires additional bandwidth, and suffers from update glitches inherent in Midi's flawed asynchronous definition of 14-bit controllers. (To avoid the glitches, the synthesizer can do synchronous 14-bit updates with output from the Continuum: simply save the least significant data, and do not apply it until the most significant data is received.)
127 (MPE)	Use MPE encoding. This will encode Z position as Channel Pressure. In addition, Controller 127 on channel 1 specifies polyphony, RPN 0 on channel 2 specifies pitch bend range. NB: As per MPE standard, the Continuum will encode notes starting on channel 2, up to channel P+1 (where P is polyphony).

10.10. Midi Note Processing

Midi key 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.

Midi Note Processing	
0	Static: Midi key velocity is always 127.
1	Dynamic: Midi key velocity depends on initial finger velocity.
2	Formula: Midi key velocity is computed by EaganMatrix formula V. Use this only with an EaganMatrix preset that has formula V specially designed for velocity values.
3	No Note Output: The Continuum does not output Midi Note and Pitch Bend information.
4	External Note Mode: For EaganMatrix sounds designed for use with Midi keyboards or sequencers. Such EaganMatrix sounds process notes coming in on Midi Channel 1, and add continuous control using the Continuum's Touche. A Formula Blend control (see the EaganMatrix User Guide) allows specialized processing for notes coming from Midi channel 1 vs. notes from the Continuum's playing surface, to adjust for the coarse aftertouch and limited pitch abilities of Midi keyboards and sequencers.
5	Ethervox Mode: Always uses 60 for the Midi key number, and all bends are referenced from Middle C. This is the type of encoding used by the Moog Ethervox Theremin.
6	Kyma Mode: 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. Kyma will automatically update the Continuum Fingerboard when sounds are loaded and changed inside Kyma. Kyma-controlled Continuum Fingerboard parameters include: Polyphony, X Bend, Y Controller, Z Controller, and Splits. ◉ All affected Kyma parameters will have blue text in the Continuum Editor. Technical details: 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. In this special Kyma mode, Continuum notes are transmitted on high-numbered Midi channels starting with channel 16.

Midi Note Processing
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.

10.11. 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.

Middle C	
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.
◉	Drag the red triangle to adjust Middle C.

10.12. Split Point and Split Mode

You may select a playing surface split point. For the split point to have effect, 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.

Split Point	
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.

Split Mode		Notes
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.

For example:

With a polyphony of 4, 8 total notes are possible: 4 from Midi or CVC, and 4 from the internal synth. |
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.	
6	For Combination Presets: DSP 1 plays notes below the split point, DSP 2 and DSP 3 layer (double) notes above the split.	These split modes split are exclusively for use with CEE Combination Presets; see details in Section 8.9.
7	For Combination Presets: DSP 1 plays notes above the split point, DSP 2 and DSP 3 layer (double) notes below the split.	
8	For Combination Presets: DSP 1 plays notes below the split point, DSP 2 plays notes above the split point, and DSP 3 provides polyphony expansion for DSP 2. The DSP 2 and DSP 3 preset should be identical.	
9	For Combination Presets: DSP 1 plays notes above the split point, DSP 2 plays notes below the split point, and DSP 3 provides polyphony expansion for DSP 2. The DSP 2 and DSP 3 preset should be identical.	
10	For Combination Presets: DSPs within the Combination are sequentially selected with Half Advance Pedal (see Section 14.3). If notes are held from the previous DSP, they will continue to sound, but new notes will be on the new DSP.	

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 10.6.)

A multi-split mechanism is available for use by third-party software, but it is neither saved in presets nor is it displayed in the Editor. Technical details: Controllers 88 and 89 on Midi channels 1-16 override the split normally used in the Continuum Fingerboard; cc 88 specifies the lowest note number allowed on the Midi channel; cc 89 specifies the highest note number allowed on the Midi channel.

10.13. 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 6.3 for details). The Mono Function lets you select what kind of transitions to use. (Mono can also be used for other purposes, see Section 6.3.)

Mono Function	
0	Portamento - smooth pitch transitions, based on the relative Z values of fingers
1	Legato Z - smooth amplitude transitions, max Z finger is played
2	Retrigger Z - retrigger at transitions, max Z finger is played
3	Legato T - legato to new touch, no retriggering during transition
4	Retrig T - retrigger at new touch
5	Retrig TL - retrigger at new touch and at finger lift
6	Legato TZ - legato to new touch, no retriggering during transition, use max Z of all fingers
7	Retrig TZ - retrigger at new touch, use max Z of all fingers
8	Retrig TLZ - retrigger at new touch and at finger lift, use max Z of all fingers

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.

Mono Interval	
0	Disabled.
1 to 127	Sets the range in half steps of the mono interval.
◉	The Continuum Editor has a reduced selection set comprised of the most useful values. Also, the Mono Function can be enabled and disabled via the switch in 10.13 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 14.3, or via the Editor as described above.

10.14. Round Initial, Normal Rounding, Release Rounding, Rounding via Y

The Continuum Fingerboard's "Finger Position Rounding" features help a performer sound in tune, when the performer cannot place fingers for proper intonation. Please thoughtfully consider the pros and cons of rounding finger position in Section 6.4 before using the "Finger Position Rounding" feature.

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 Sections 6.4 and 10.16). Subsequent vibrato and glissando finger moves are interpreted at full micro-pitch resolution until a new note is sounded.

After the finger first touches the surface, several additional options are available for rounding:

Normal Rounding: The Round Rate pitch correction (Section 10.15) will automatically round finger positions to the nearest half step any time during a note and after the finger is lifted.

Release Rounding: The Round Rate pitch correction (Section 10.15) 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 takes effect only after a finger is lifted. See Section 6.4 for details.

Rounding via Y Position: When the ***finger position is at Y=0***, the pitch is the nearest half step. A vibrato effect can be achieved by rocking the finger right and left. (Technically, this vibrato-like pitch variation is based on the finger's X derivative.) When the ***finger position is at Y=1***, the "Normal Rounding" occurs. Thus, if the Round Rate is zero (Section 10.15), no rounding occurs at Y=1. If the Round Rate is a medium value (for example, 70), mild rounding occurs at Y=1. When the ***finger position is between Y=0 and 1***, then a combination of the Y=0 and Y=1 pitch correction methods is used.

Rounding via Y-Reversed: This is the same as "Rounding via Y Position", for the reverse of Y.

Round Initial, Release Rounding, and Rounding Via Y (using Overlay Strip)	
0	Normal Rounding enabled (using Round Rate value), Round Initial disabled.
1	Normal Rounding enabled, Round Initial enabled.
2	Release Rounding enabled, Round Initial disabled.
3	Release Rounding and Round Initial enabled.
4	Rounding via Y enabled, Round Initial disabled.
5	Rounding via Y and Round Initial enabled.
6	Rounding via Y-Reversed enabled, Round Initial disabled.
7	Rounding via Y-Reversed and Round Initial enabled.

10.15. 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 centred at the nearest half step. Please thoughtfully consider the pros and cons of rounding finger position in Section 6.4 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) The Round Rate mechanism is a separate feature from Round Initial (Section 10.14), 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 10.14).

(3) You can use foot pedals to influence the round rate as you play; see details in Section 14.

10.16. Tuning (Select Pitch Table)

The Continuum Fingerboard allows you to select Pitch Tables, for use with rounding (Sections 10.14 and 10.15) or for radical pitch transformations of the playing surface (Section 6.4).

Tuning (Select Pitch Table)	
0	12-tone equal tempered tuning (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 centres. 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 Pitch Tables. A graphical Pitch Table Editor, and its User Guide, are available in the cogwheel menu (see Sections 6.4 and 10.22).

10.17. Pedal 1 and Pedal 2

Use Pedal 1 and Pedal 2 to select a Midi controller (cc) for the quarter inch pedal jacks (Section 6.5). 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 the performance controller numbers that has special meaning to the Continuum Fingerboard. For example, 64 is Sustain, 66 is Sostenuto, 69 is a second Sostenuto, 8 is Octave Shift (works with the Tri-Value Pedal), 9 is Mono Switch, 20 through 24 are Recirculator controls for the Internal Sound, and 31 is the Advance pedal. See Section 14.3 for a complete pedal listing.

Pedal 1 and Pedal 2	
9-10,12-31, 64-69, 80-83	Continuous controller number (cc) for pedal 1 or pedal 2.
◉	A subrange of data values can be created using the Min and Max controls in the Editor (see below).

10.18. Pedals 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.
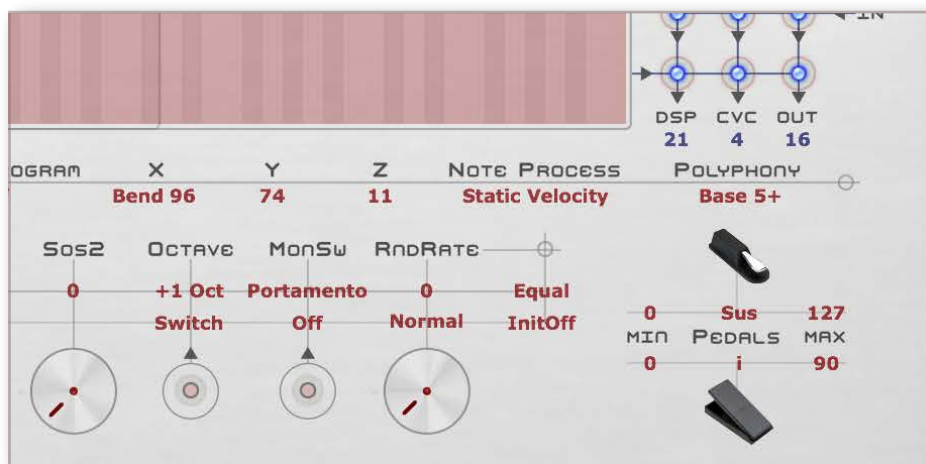
Pedal 1 assigned to sustain with a range of 0-127, and Pedal 2 assigned to Barrel i with a range of 0-90.

10.19. 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 8, 9, and 127 are not available in the Editor.

Options	
0	This will disable any of the Options below that were previously enabled.
1	Medium Action. ◉ In "Midi and Global Settings" (in the cogwheel menu).
2	Digital audio output syncs to digital audio input. ◉ AES options are in "Midi and Global Settings" (in the cogwheel menu).
3	Digital audio output rate at 48 kHz. ◉ AES options are in "Midi and Global Settings" (in the cogwheel menu).
4	Make octave foot switch transpose two octaves instead of one octave. ◉ 4.18b
5	Make octave foot switch transpose four octaves instead of one octave. ◉ 4.18b
6	Reverse X (pitch), so the lower notes are to the right and the higher notes to the left. ◉ 4.18a
7	Disables Continuum Fingerboard's recirculator. Useful if you prefer an external reverb. ◉ This option is in "Midi and Global Settings" (in the cogwheel menu), as well as an option to enable the recirculator on the analog headphone output but but disable it on AES3.
8	Limit Continuum Fingerboard's Midi transmission to 8% of the Midi bandwidth (200 Byte/sec).
9	Limit Continuum Fingerboard's Midi transmission to 5% of the Midi bandwidths (150 Byte/sec).
10	Load User Preset Slots with "Demo Assortment." ◉ This option is in the Group menu.
127	Factory reset.

See additional text for certain options below.
Option 1: Continuum Fingerboards built after 2012 are capable of Light Action, responding to lighter finger pressure than the Classic Action of older Continuum Fingerboards. Choosing Medium Action makes a newer Continuum's action equivalent to the Classic Action. **Option 2:** Use external clock sync from the AES3 input. The Continuum Fingerboard's Led while 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 3:** Causes the external digital audio output to transmit at 48 kHz instead of the default rate of 96 kHz. **Options 4 and 5:** Additional transposition values are available using the Continuum Editor. Settings can range from +- 4 octaves in one octave increments. **Option 8 and 9:** This data rate is much too slow for Continuum playing, but convenient for configuration with wireless Continuum Remote apps. See Section 15.7. **Option 127:** Factory reset sets all presets (the current configuration as well as Internal User Preset Slots 1-16) and the Global options to factory default.

10.20. Send

Send	
1	Transmit current configuration via Midi, using the messages described in Section 15.

10.21. Load and Store (User Preset Slots)

Load	
1 to 16	This will load from the selected Internal User Preset Slot. **A single-touch alternative** is available for loading user 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 user preset number. This saves the intermediate step of pressing "load". **Hardware alternatives** are also available for loading user presets, see Sections 6.6, 6.7, and 6.8.
◉	Click on one of the 16 Internal User Presets to load the current configuration from it (Section 8.6).

Store	
1 to 16	This will store into the selected Internal User Preset Slot. It will also store the Global settings internally.
◉	Shift-click on one of the 16 Internal User Presets to store the current configuration into it, or drag a preset file from the Finder (Mac) or Explorer (Windows) and drop it onto one of the Internal User Presets (Section 8.6).

10.22. Cogwheel Menu: Global Settings, Kenton Settings, Pitch Table Editor, User Guides, Editor Shortcuts, Barrel Styles, List of System Presets, About

Cogwheel Menu: Midi and Global Setting	
◉	Select USB-Midi connections for the Editor (Section 8.1), and set Global settings: Recirculator Enable, Light Action, Preserve Parameters (see below), and AES Digital Audio Rates. Shortcut: Command+G (Mac) or Control+G (Windows).

Preserve Parameters (in Midi and Global Settings): When a preset is opened from your Mac or Windows computer, or when a preset is loaded from an Internal User Preset Slot, you may globally preserve the existing values of certain sets of parameters as follows:

Midi Encoding:	X Bend, Y Controller, Z Controller, Midi Note Processing, Midi Program, Midi Routing, CVC Standard CV Definition
Pedal:	Pedal Assignments, Pedal Min/Max, Octave Shift Effect
Surface Processing:	Channel Priority, Reverse, Split, Transpose, Mono Switch, Mono Interval, Mono Function, Round Rate, Pitch Table

Cogwheel Menu: Kenton Settings	
◉	View and customize functionality of Kenton Mini Controller. Separate Kenton Settings are stored for each preset (see Section 6.6). Shortcut: Command+K (Mac) or Control+K (Win).

Cogwheel Menu: Pitch Tables Editor	
◉	A graphical editor for creating custom downloadable Pitch Tables, written by Pablo De La Loza (see Section 6.4, and the Pitch Tables Editor User Guide in the Cogwheel menu).

Cogwheel Menu: User Guides	
◉	Select "Continuum User Guide," "EaganMatrix User Guide," "CEE User Guide," "CVC User Guide," or "Pitch Tables Editor 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.

Cogwheel Menu: Editor Shortcuts	
◉	A reference list of keyboard shortcuts and mouse drags available in the Continuum Editor.

Cogwheel Menu: Barrel Styles	
◉	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, or automatically animate them (click top left of window). Shortcut: Command+B (Mac) or Control+B (Win).

Cogwheel Menu: List of System Presets	
◉	Creates a text list of System Presets. You can copy and paste the preset list into your favourite word processor for formatting or printing. The list includes the system preset numbers required for loading presets using the Overlay Strip (Section 10.2).

| **Cogwheel Menu: About**	
◉	Select "About" to see the Editor version, as well as information on the Editor authors Edmund Eagan and Lippold Haken.

10.23. Surface Display

A detailed visual display of finger activity on the Continuum Fingerboard can be activated by clicking on this menu in the Editor:
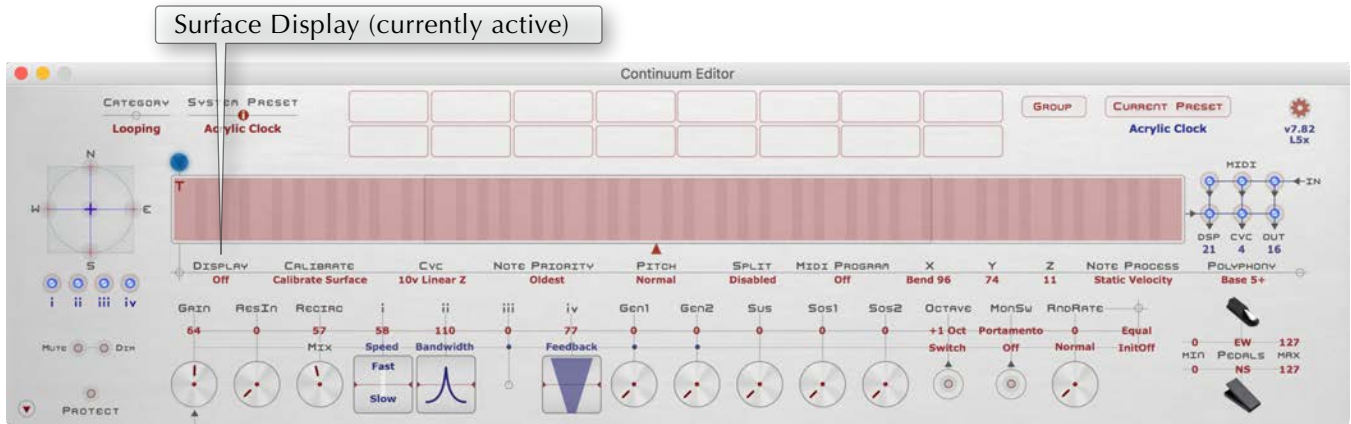
When the Surface Display is turned on, finger activity from the Continuum Fingerboard's playing surface will be displayed on on-screen Continuum surface. Each new note played will display as a combination of a circle, line, number, and a pair of triangles:

- Circle diameter: Pressure (Z) value, larger diameter means more pressure.
- Circle placement: Centre of circle reflects the left-to-right (X) position.
- Line: Deviation left-to-right from vertical reflects the pitch deviation from nearest equal temperament pitch.
- Triangle Pair (Y position): The lower triangle gets darker as finger is towards the front; upper triangle gets darker as finger is towards the back.
- Numerical: The Midi channel of the note.
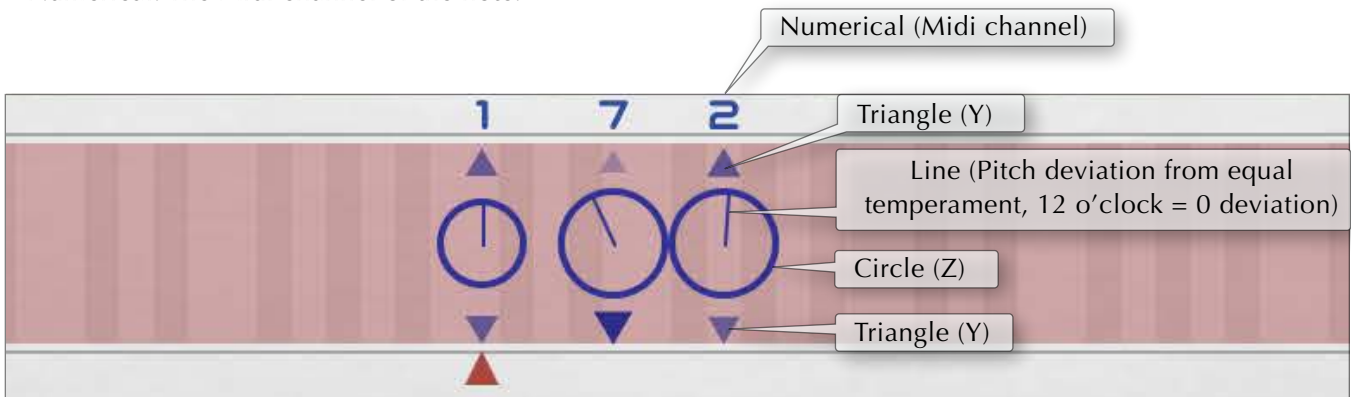
The Surface Display showing a just-tuned C major chord. In just tuning the third is noticeably flat compared to an equal temperament third and the fifth is slightly sharper.

10.24. Pitch Trim

Editor Only:

Some algorithms for sound generation, such as physical models that use delays, generate pitches that are sharp or flat over parts of their pitch range. The Pitch Trim functionality provides a way for the preset designer to correct for this. The Pitch Trim consists of two user-definable graphs, overlaid onto the Surface Display (see Section 10.23). The blue pitch graph is for Y=0 Pitch Trim, and the red pitch graph is for Y=1 Pitch Trim. The Pitch Trim is particular to each preset, and will be stored with the preset.

Pitch Trim   A Trim Value
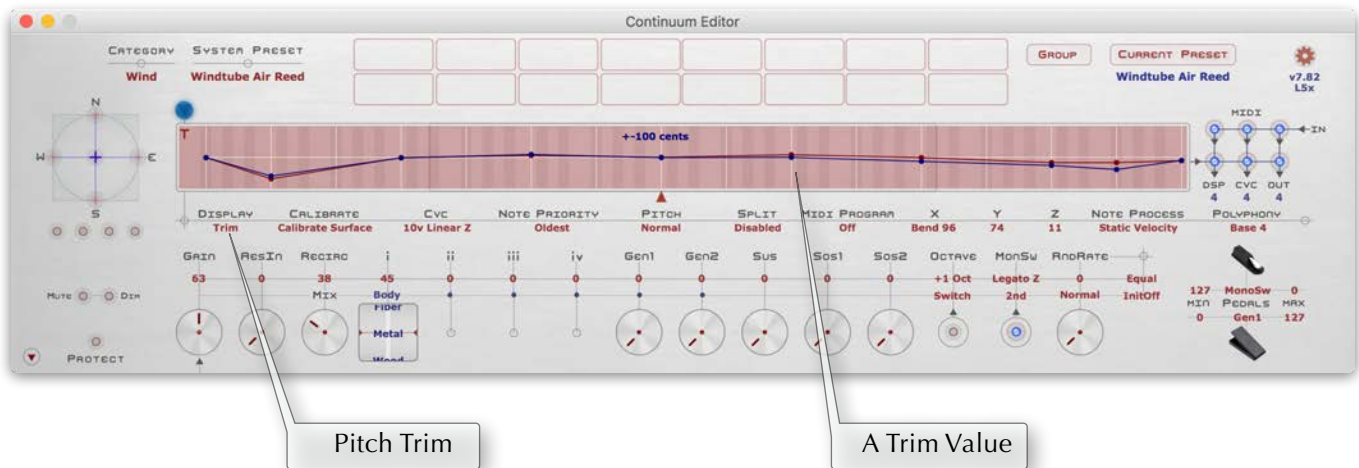
To see the Pitch Trim graphs, select Pitch Trim from the Surface Display menu. Each Pitch Trim graph can specify a trim value at half-octave positions; these half-octave positions are indicated with vertical white lines on the Pitch Trim display.

To add a trim value to the Pitch Trim graph, place a finger on the surface at Y=0 (to add to the Y=0 graph) or Y=1 (to add to the Y=1 graph) at one of the half-octave positions. Then move the finger until the pitch generated is correct for that half-octave position, and choose "Add Current Pitch" from the Surface Display menu (or type "=").

To remove a trim value you added previously, place a finger on the surface at Y=0 (to remove from the Y=0 graph) or Y=1 (to remove from the Y=1 graph) at the half-octave point, and choose "Delete Trim Value" from the Surface Display menu (or type "-").

The remove all pitch trim values, choose "Reset Trim" from the Surface Display menu.

The Pitch Trim functionality should not be confused with the Pitch Table Editor, which is available in the Cogwheel menu (see Section 6.4 for more about Pitch Tables).

11.   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). Make sure the Editor is communicating with your Continuum Fingerboard as outlined in Section 8.1, then go to the Continuum Editor's Midi and Global Settings (in the cogwheel menu).

2. With the Editor still 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.
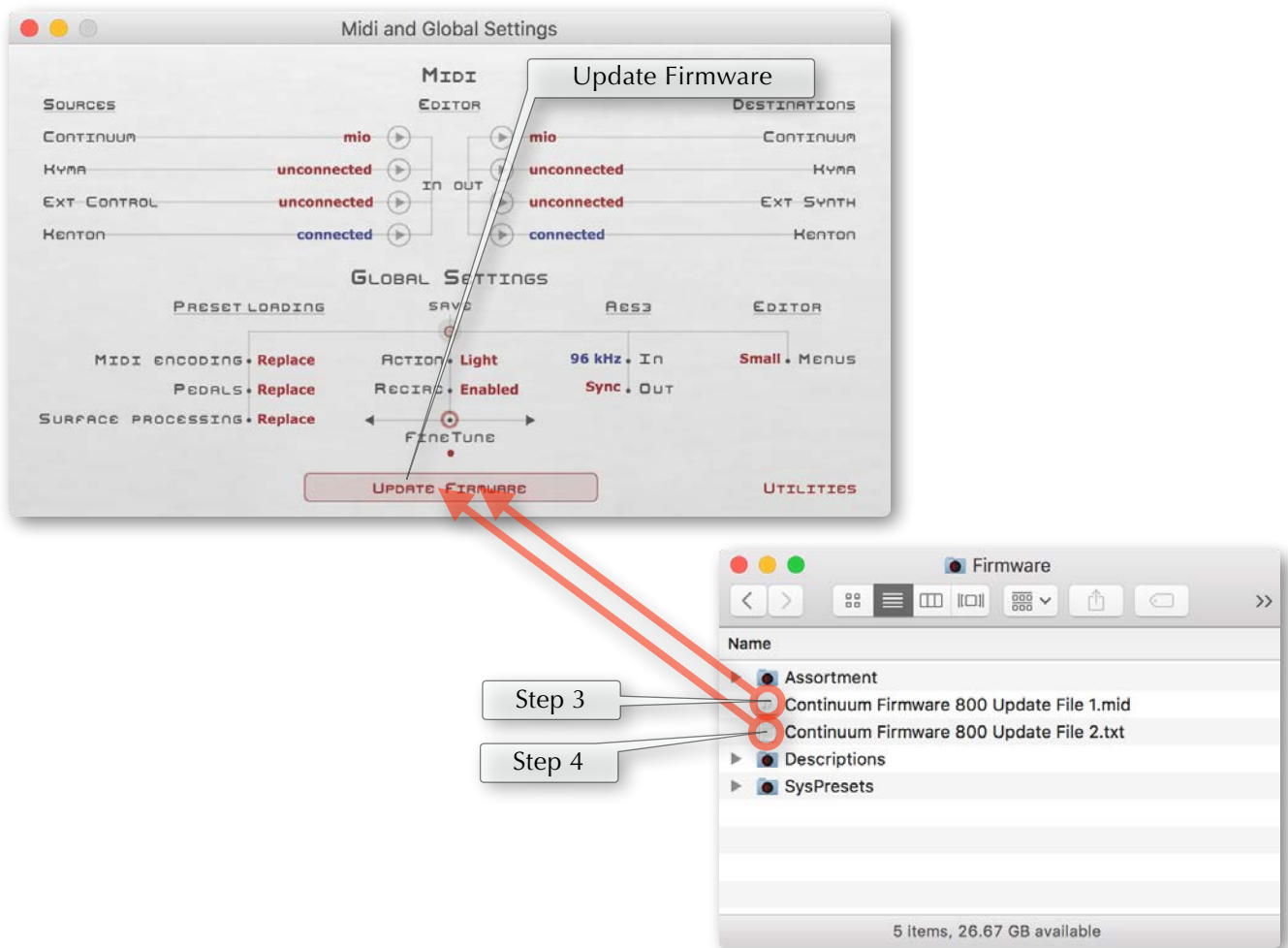
3. Drag the first firmware file and drop it onto Update Firmware in Midi and Global Settings (in the cogwheel menu; see image above). The Editor will start loading the data into the Continuum. During this process the Continuum Fingerboard's LED will shine yellow, and the Editor will display a progress percentage. The LED should eventually change to blue and the Continuum Editor will report success.

4. Drag the second Firmware file and drop it onto Update Firmware (see image above). The LED will shine yellow; when it changes back to blue the download status display will report success. Your firmware update is now complete.

If you have trouble with your USB-Midi cable:
(1) Try resetting the USB-Midi cable by unplugging and replugging its USB connector.
(2) If you continue to have problems, try connecting your USB-Midi cable through a **powered USB hub**.

## 12.   Connecting to External Hardware and the Editor

The following are a number of recommended configurations for connecting the Continuum Fingerboard and it's accessories to external hardware. Also shown where appropriate is the settings for the Continuum Editor's "Midi and Global" page (Section 8.1).

12.1. Analog Audio Only
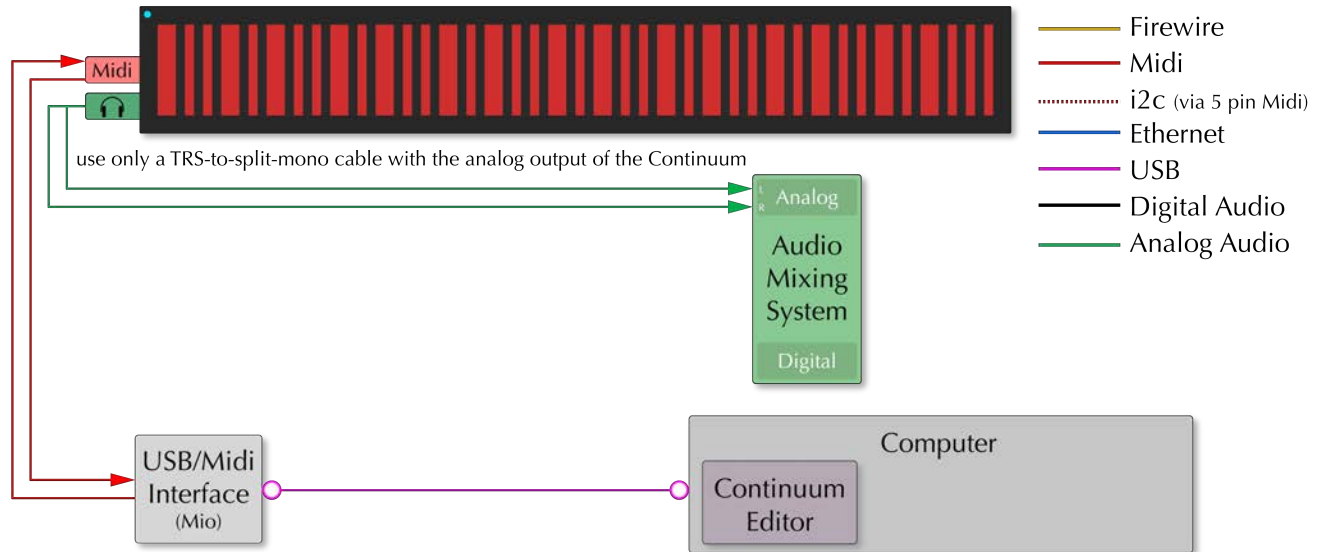
Analog Audio: The Continuum's analog headphone output is connected to an external audio mixer. It is important not to mono sum the audio signals from the Continuum; a TRS-to-split-mono cable must be used.

Continuum Editor: Connections to the Editor on an external computer are made through the supplied iConnectivity Mio (or Midimate2) USB connection, which is auto-detected and shows up in the "Midi and Globals" page of the Editor.
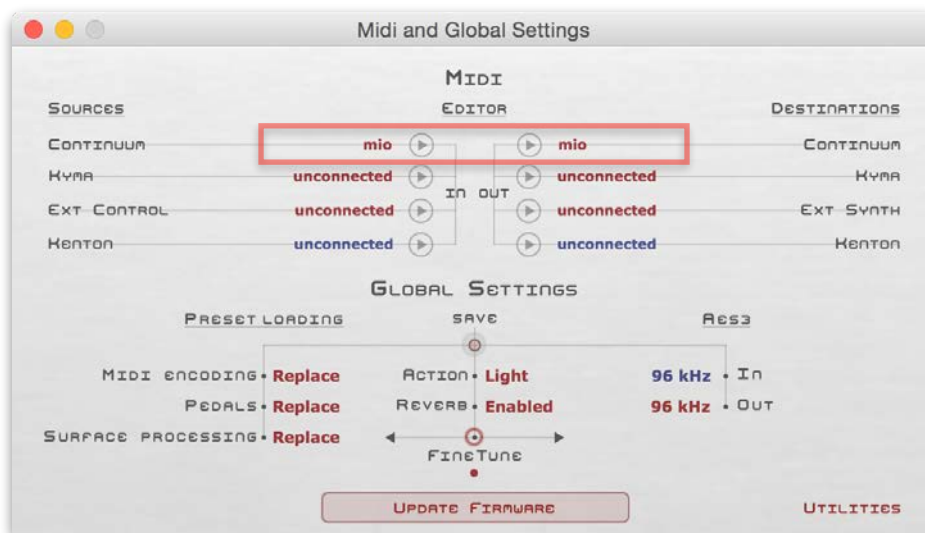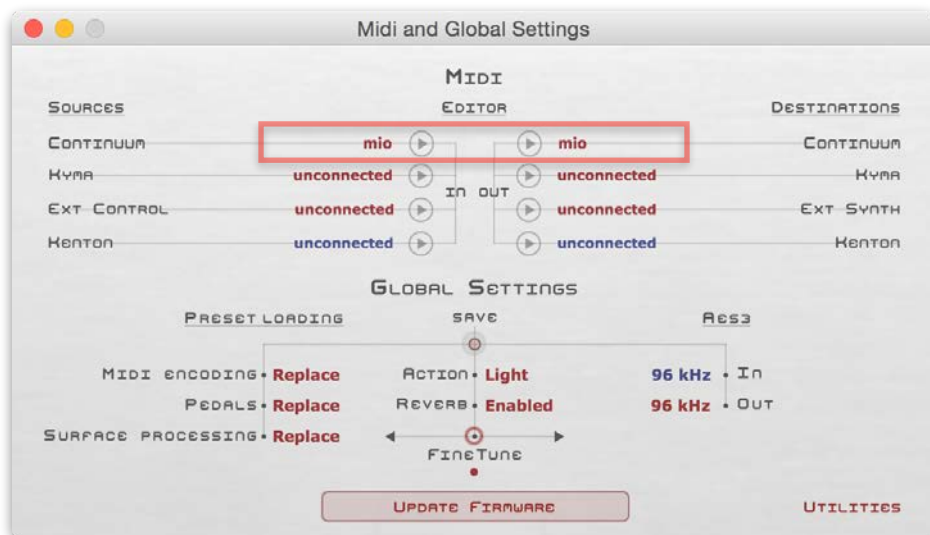
12.2. Digital Audio
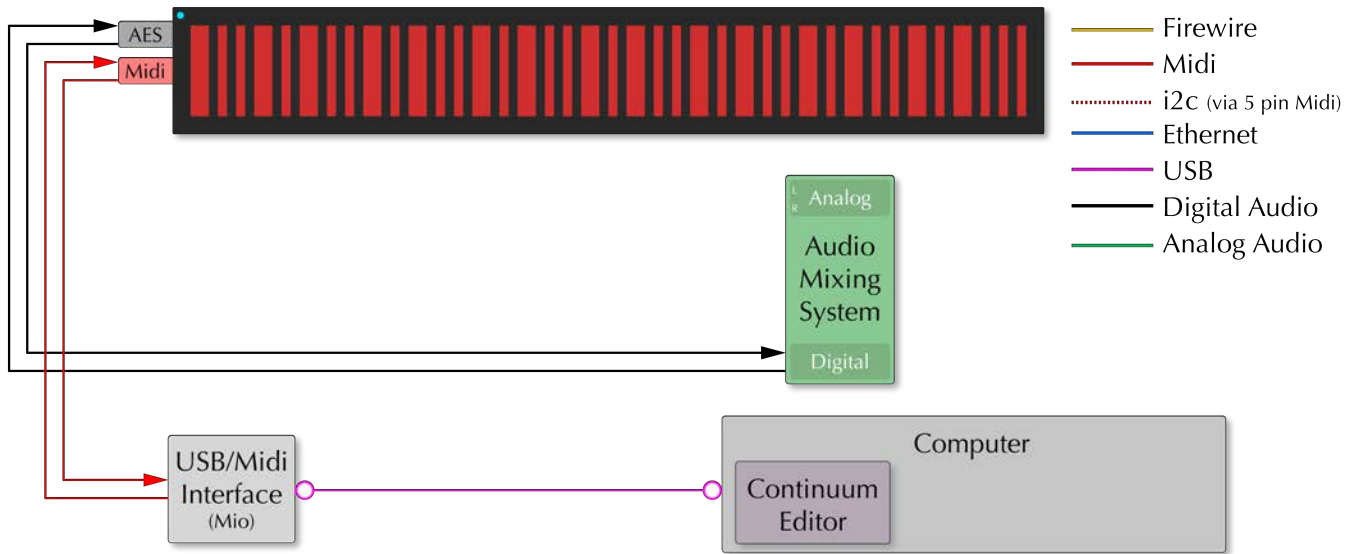
Digital Audio: The Continuum's digital output is connected to an external audio mixer. A digital signal is fed back to the Continuum so that the Continuum can optionally sync to the AES signal supplied by the external source. Notice that the Sync out in the Editor has been set to "sync to incoming", so that the Continuum can sync to that digital signal. Successful digital clocking will report "Sync".

Continuum Editor: Connections to the Editor on an external computer are made through the supplied iConnectivity Mio (or Midimate2) USB connection, which is auto-detected and shows up in the "Midi and Globals" page of the Editor.
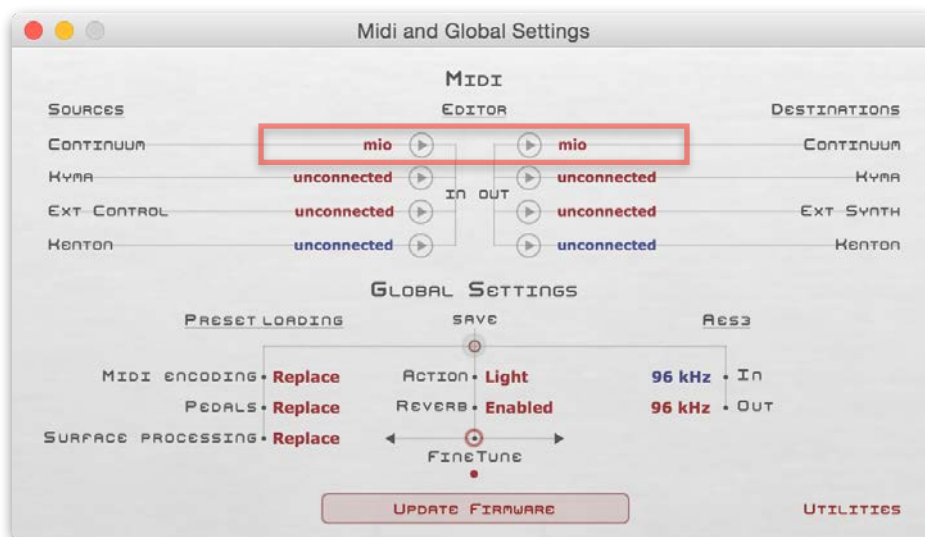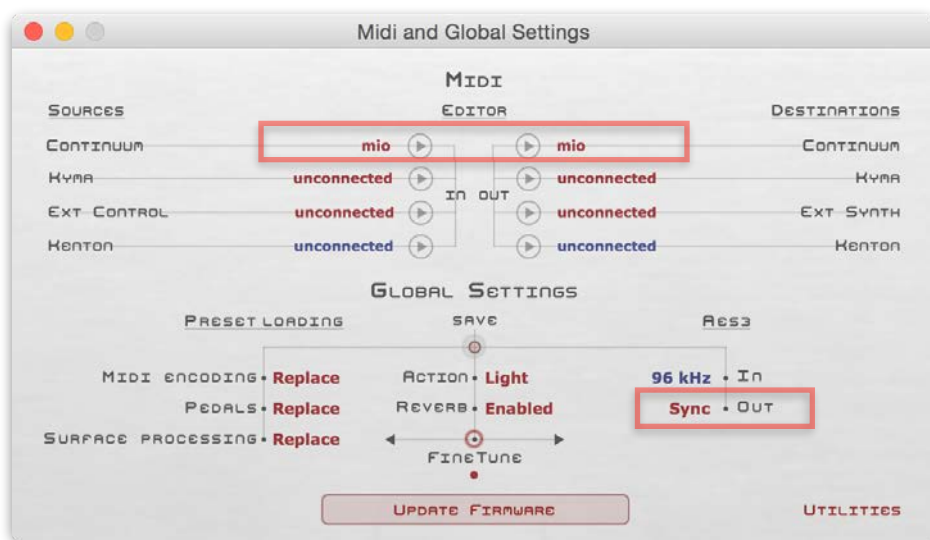
12.3. Analog Audio and CVC
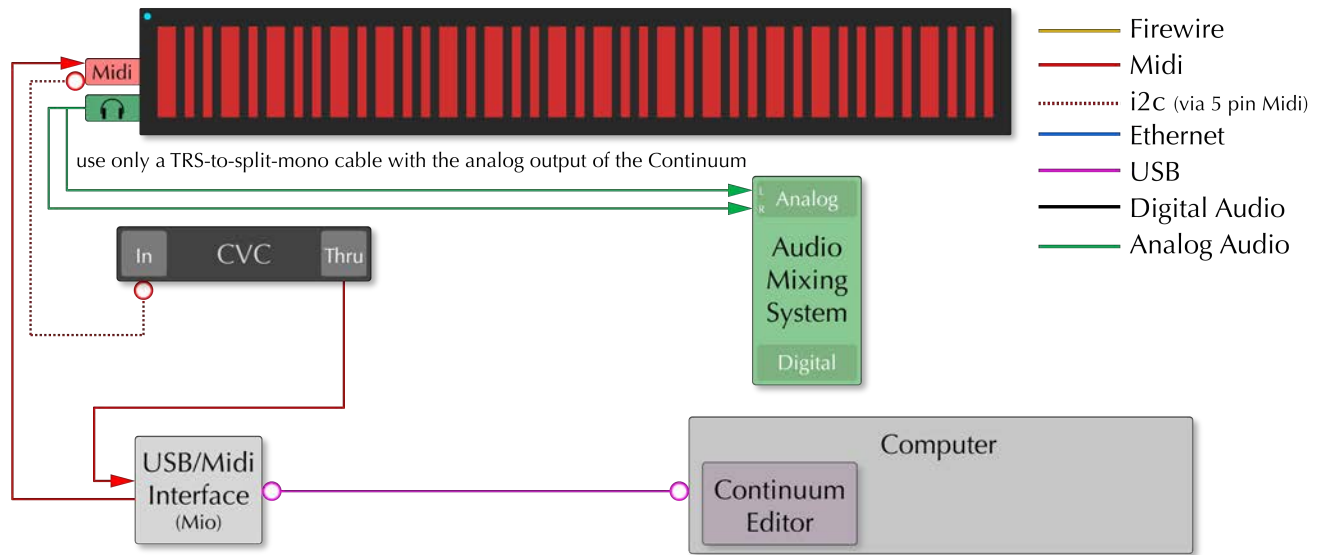
Analog Audio: The Continuum's analog headphone output is connected to an external audio mixer. It is important not to mono sum the audio signals from the Continuum; a TRS-to-split-mono cable must be used.

CVC: The CVC is connected to the Continuum via the i2c information that is carried through the unused pins of the Midi cable. The i2c cable is a high quality Midi cable with all 5 pins connected. It connects the Midi Out of the Continuum to the In on the CVC.

Continuum Editor: Connections to the Editor on an external computer are made through the supplied iConnectivity Mio (or Midimate2) USB connection, which is auto-detected and shows up in the "Midi and Globals" page of the Editor.
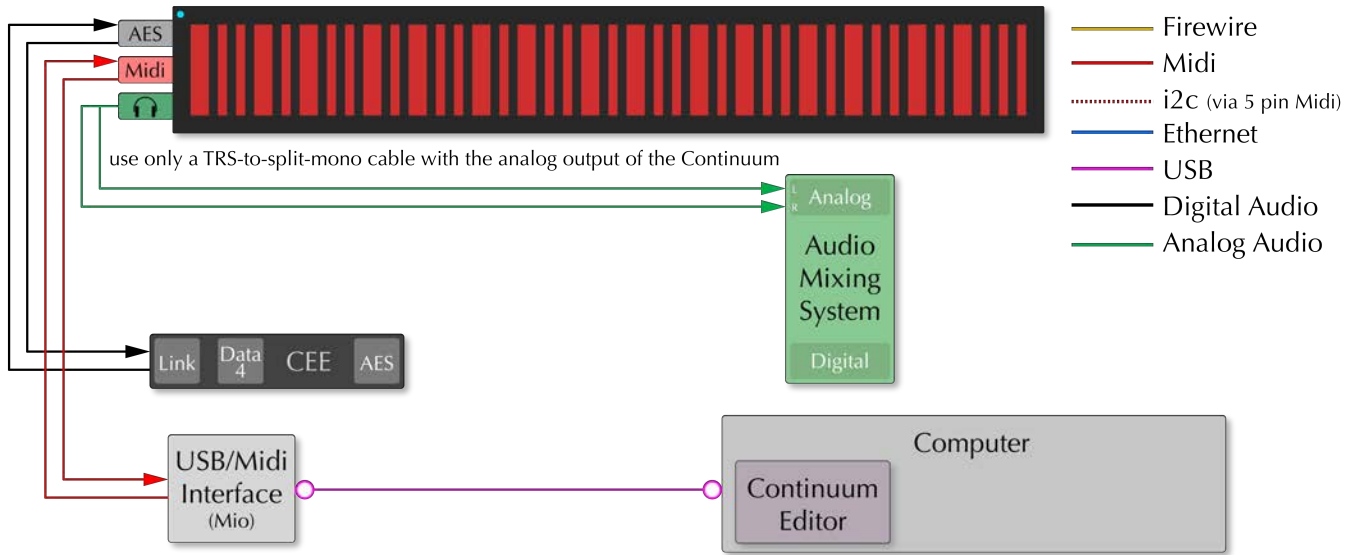
12.4. Digital Audio and CVC
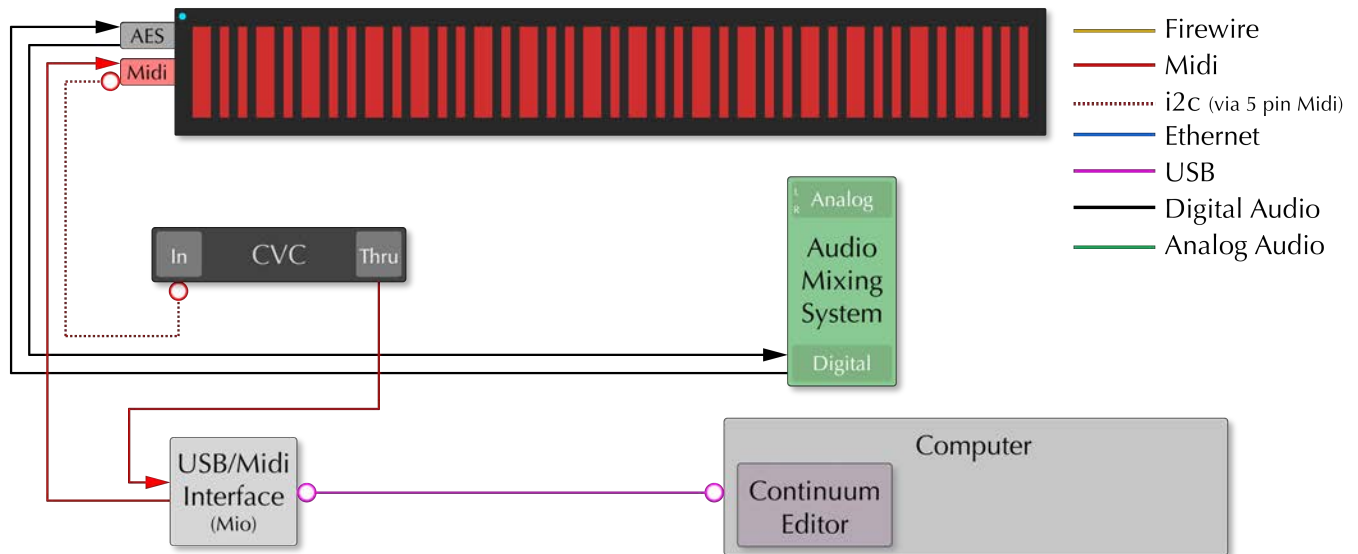
Digital Audio: The Continuum's digital output is connected to an external audio mixer. A digital signal is fed back to the Continuum so that the Continuum can optionally sync to the AES signal supplied by the external source. Notice that the Sync out in the Editor has been set to "sync to incoming", so that the Continuum can sync to that digital signal. Successful digital clocking will report "Sync".

CVC: The CVC is connected to the Continuum via the i2c information that is carried through the unused pins of the Midi cable. The i2c cable is a high quality Midi cable with all 5 pins connected. It connects the Midi Out of the Continuum to the In on the CVC.

Continuum Editor: Connections to the Editor on an external computer are made through the supplied iConnectivity Mio (or Midimate2) USB connection, which is auto-detected and shows up in the "Midi and Globals" page of the Editor.
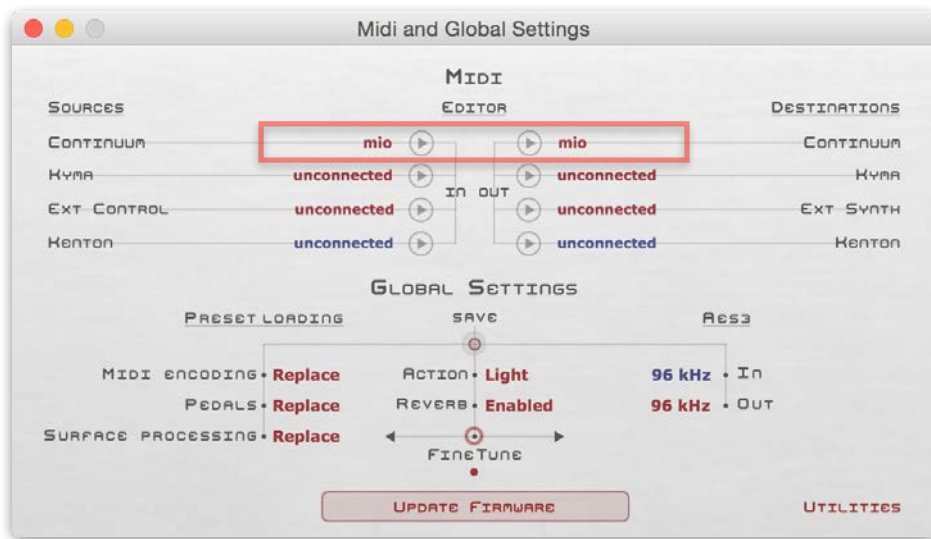
12.5. Analog Audio and CEE

use only a TRS-to-split-mono cable with the analog output of the Continuum

Firewire
Midi
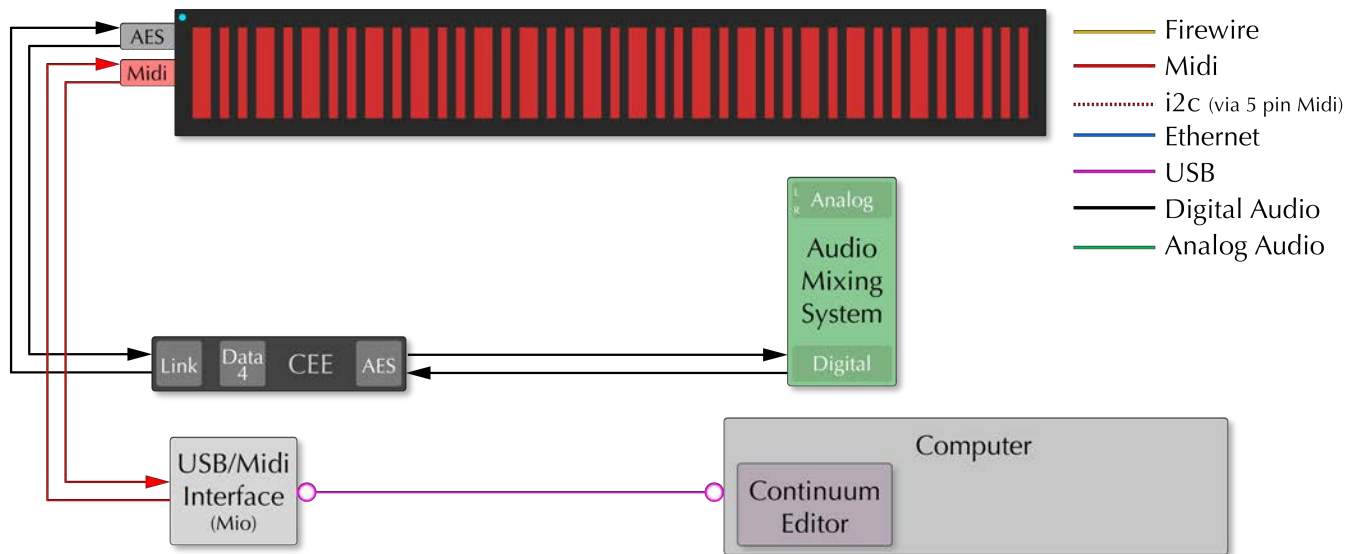i2c (via 5 pin Midi)
Ethernet
USB
Digital Audio
Analog Audio

Analog Audio: The Continuum's analog headphone output is connected to an external audio mixer. It is important not to mono sum the audio signals from the Continuum; a TRS-to-split-mono cable must be used.

CEE: The CEE is connected to the Continuum via a bidirectional connection via the AES on the Continuum to the Link on the CEE. Using analog "mic" cables instead of proper digital audio cables for this connection may compromise performance.

Continuum Editor: Connections to the Editor on an external computer are made through the supplied iConnectivity Mio (or Midimate2) USB connection, which is auto-detected and shows up in the "Midi and Globals" page of the Editor.
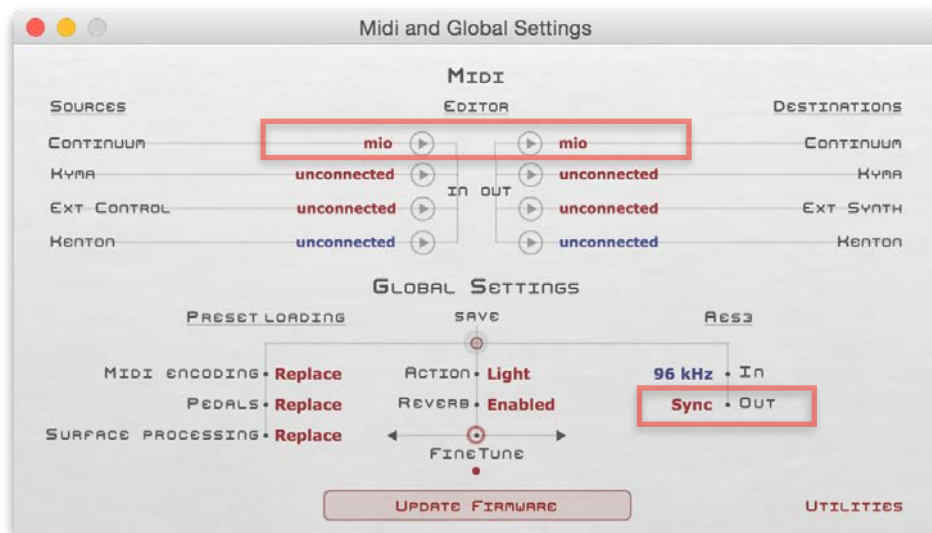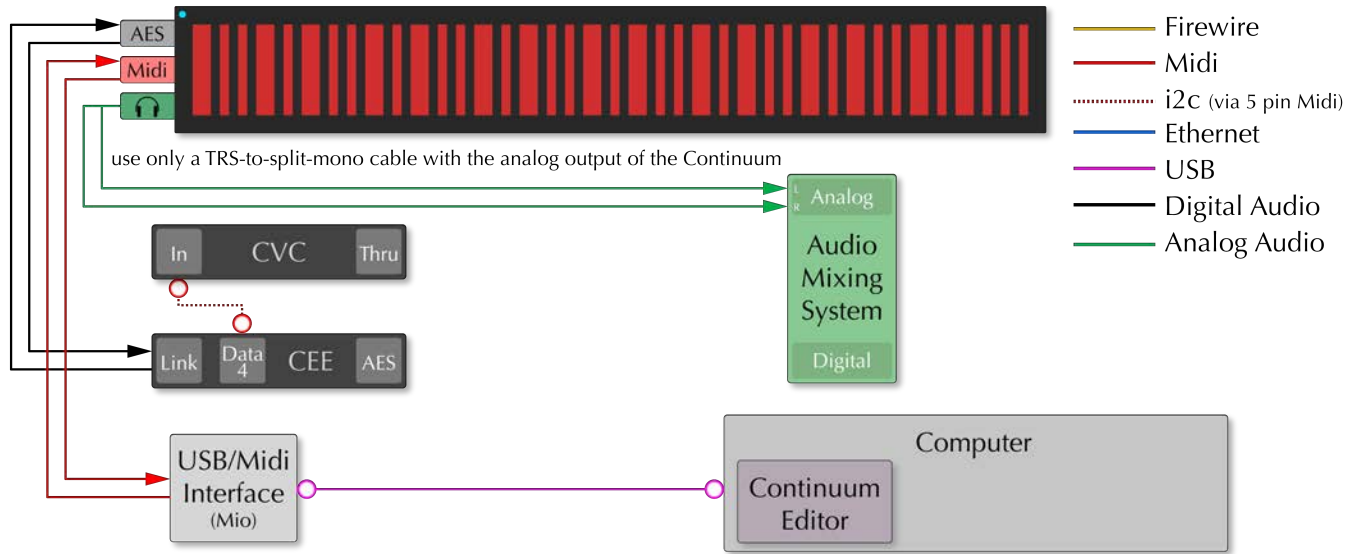
12.6. Digital Audio and CEE

Digital Audio: The CEE's digital audio output is connected to an external audio mixer. Using analog "mic" cables instead of proper digital audio cables for this connection may compromise performance. A digital signal is fed back to the CEE so that the Continuum and CEE can optionally sync to the AES signal supplied by the external source. Notice that the Sync out in the Editor has been set to "sync to incoming", so that the Continuum and CEE can sync to that digital signal. Successful digital clocking will report "Sync".

CEE: The CEE is connected to the Continuum via a bidirectional connection via the AES on the Continuum to the Link on the CEE. Using analog "mic" cables instead of proper digital audio cables for this connection may compromise performance.

Continuum Editor: Connections to the Editor on an external computer are made through the supplied iConnectivity Mio (or Midimate2) USB connection, which is auto-detected and shows up in the "Midi and Globals" page of the Editor.
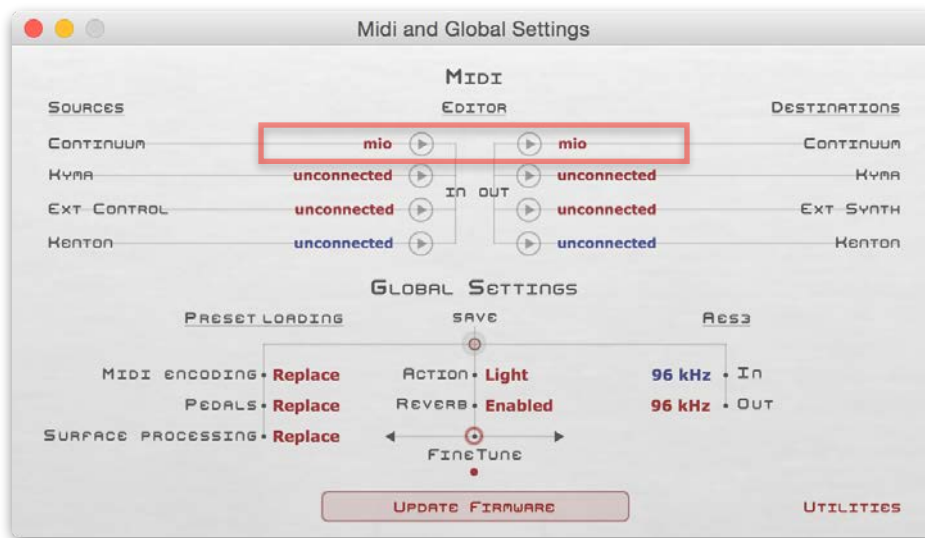
12.7. Analog Audio, CVC and CEE

Analog Audio: The Continuum's analog headphone output is connected to an external audio mixer. It is important not to mono sum the audio signals from the Continuum; a TRS-to-split-mono cable must be used.
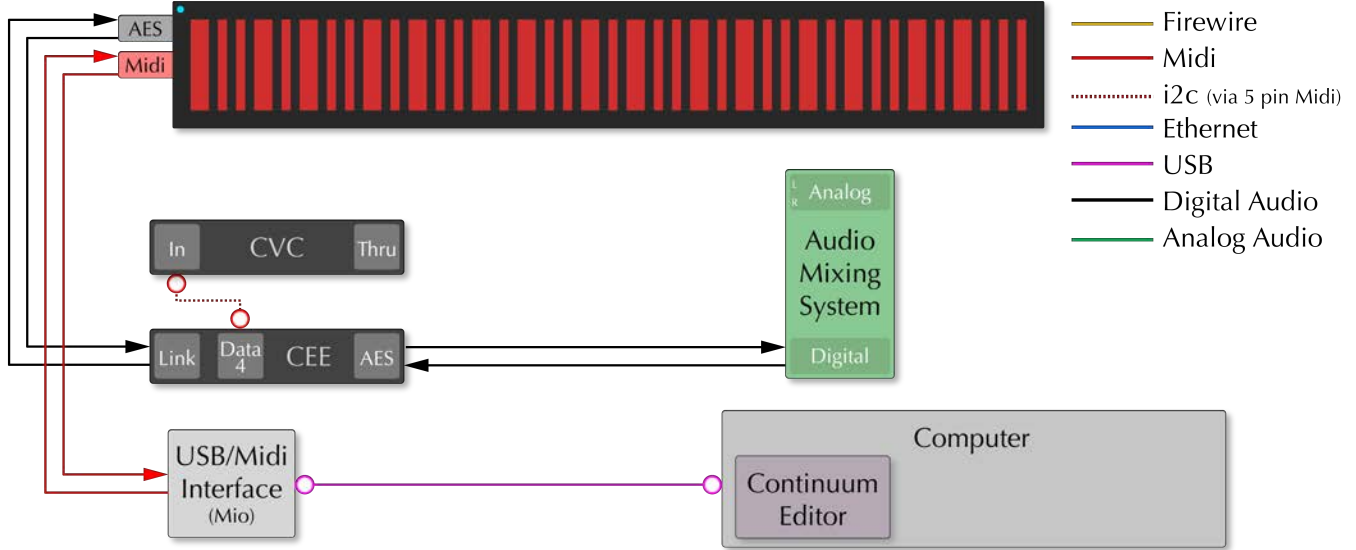
CEE: The CEE is connected to the Continuum via a bidirectional connection via the AES on the Continuum to the Link on the CEE. Using analog "mic" cables instead of proper digital audio cables for this connection may compromise performance.

CVC: The CVC is connected to the CEE using i2c. The i2c cable is a high quality Midi cable with all 5 pins connected. It connects the Data 4 port of the CEE to the In on the CVC.

Continuum Editor: Connections to the Editor on an external computer are made through the supplied iConnectivity Mio (or Midimate2) USB connection, which is auto-detected and shows up in the "Midi and Globals" page of the Editor.
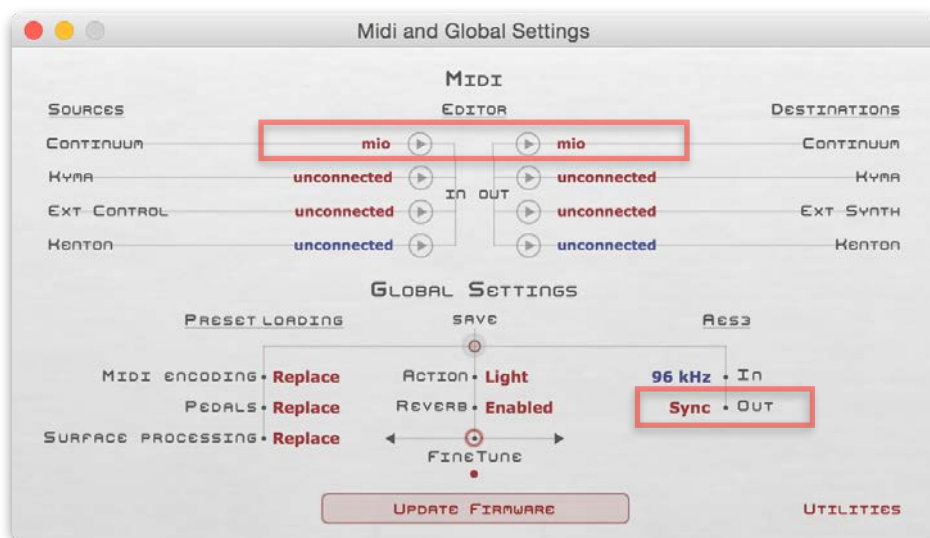
12.8. Digital Audio, CVC and CEE

Digital Audio: The CEE's digital audio output is connected to an external audio mixer. Using analog "mic" cables instead of proper digital audio cables for this connection may compromise performance. A digital signal is fed back to the CEE so that the Continuum and CEE can optionally sync to the AES signal supplied by the external source. Notice that the Sync out in the Editor has been set to "sync to incoming", so that the Continuum and CEE can sync to that digital signal. Successful digital clocking will report "Sync".

CEE: The CEE is connected to the Continuum via a bidirectional connection via the AES on the Continuum to the Link on the CEE. Using analog "mic" cables instead of proper digital audio cables for this connection may compromise performance.

CVC: The CVC is connected to the CEE using i2c. The i2c cable is a high quality Midi cable with all 5 pins connected. It connects the Data 4 port of the CEE to the In on the CVC.

Continuum Editor: Connections to the Editor on an external computer are made through the supplied iConnectivity Mio (or Midimate2) USB connection, which is auto-detected and shows up in the "Midi and Globals" page of the Editor**.**

In addition to the previous connections setups, the following are connection setups for incorporating 3rd party hardware and software.

12.9. Connecting a Softsynth
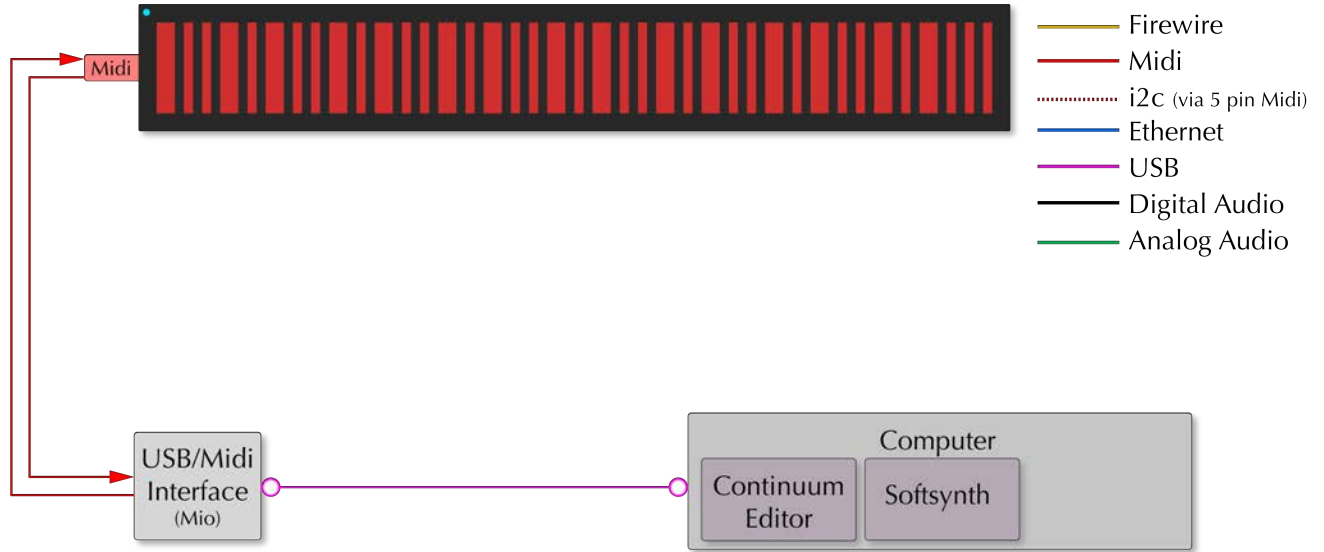
Continuum Editor: Connections to the Editor on an external computer are made through the supplied iConnectivity Mio (or Midimate2) USB connection, which is auto-detected and shows up in the "Midi and Globals" page of the Editor.

Softsynth: A Midi connection to a soft synth running on the same computer as the Continuum Editor is established by creating a virtual Midi bus, in this case labeled IAC Driver IAC Bus 1.
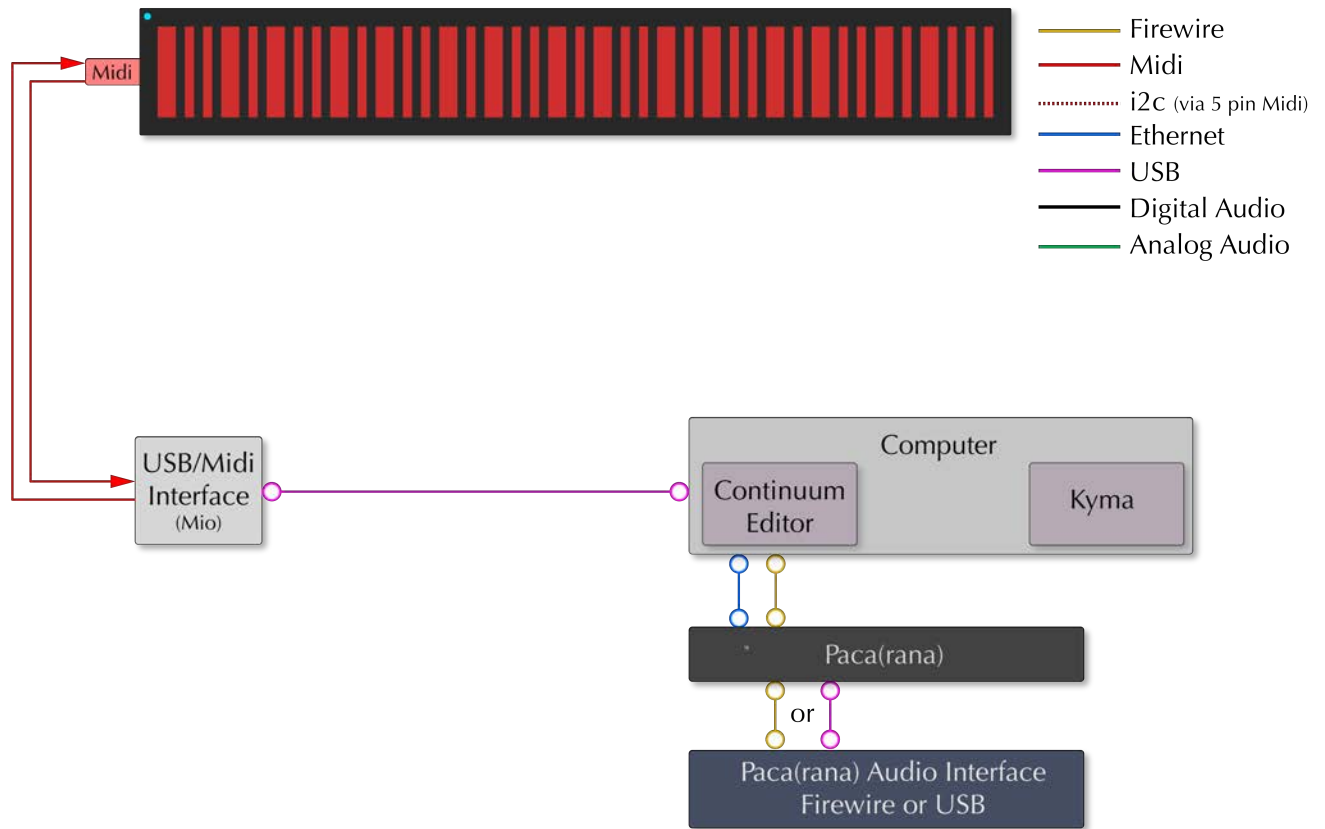
12.10. Connecting to Kyma (Mac)

Continuum Editor: Connections to the Editor on an external computer are made through the supplied iConnectivity Mio (or Midimate2) USB connection, which is auto-detected and shows up in the "Midi and Globals" page of the Editor.

Kyma: A Midi connection to the Paca(rana) and Kyma running on the same computer as the Continuum Editor is established by using Delora Software's Kyma Connect via a virtual Midi bus via ethernet called vPacarana. See Section 10.10 for a necessary Kyma-specific configuration setting.

Paca(rana): A data connection to the Paca(rana) and the computer is established via Firewire.

Paca(rana) Audio Interface: A data connection to the Paca(rana) and the Interface is either Firewire or USB, depending on the interface.
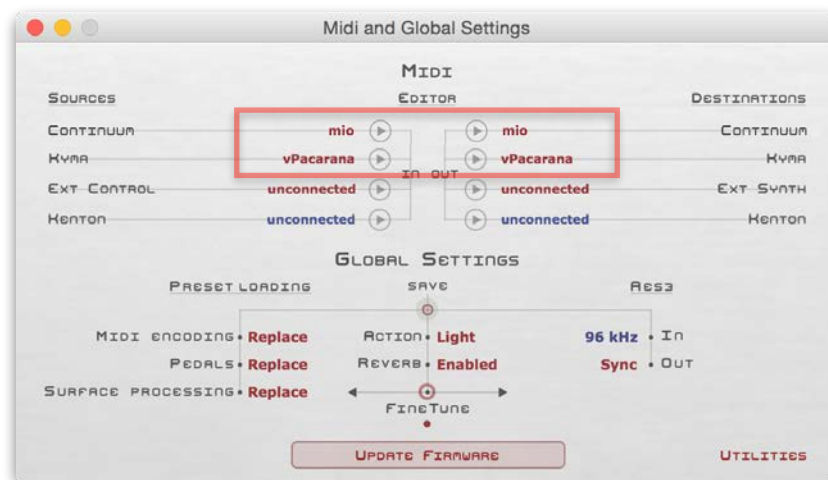
12.11. Connecting to Kyma (PC)

Continuum Editor: Connections to the Editor on an external computer are made through the supplied iConnectivity Mio (or Midimate2) USB connection, which is auto-detected and shows up in the "Midi and Globals" page of the Editor.
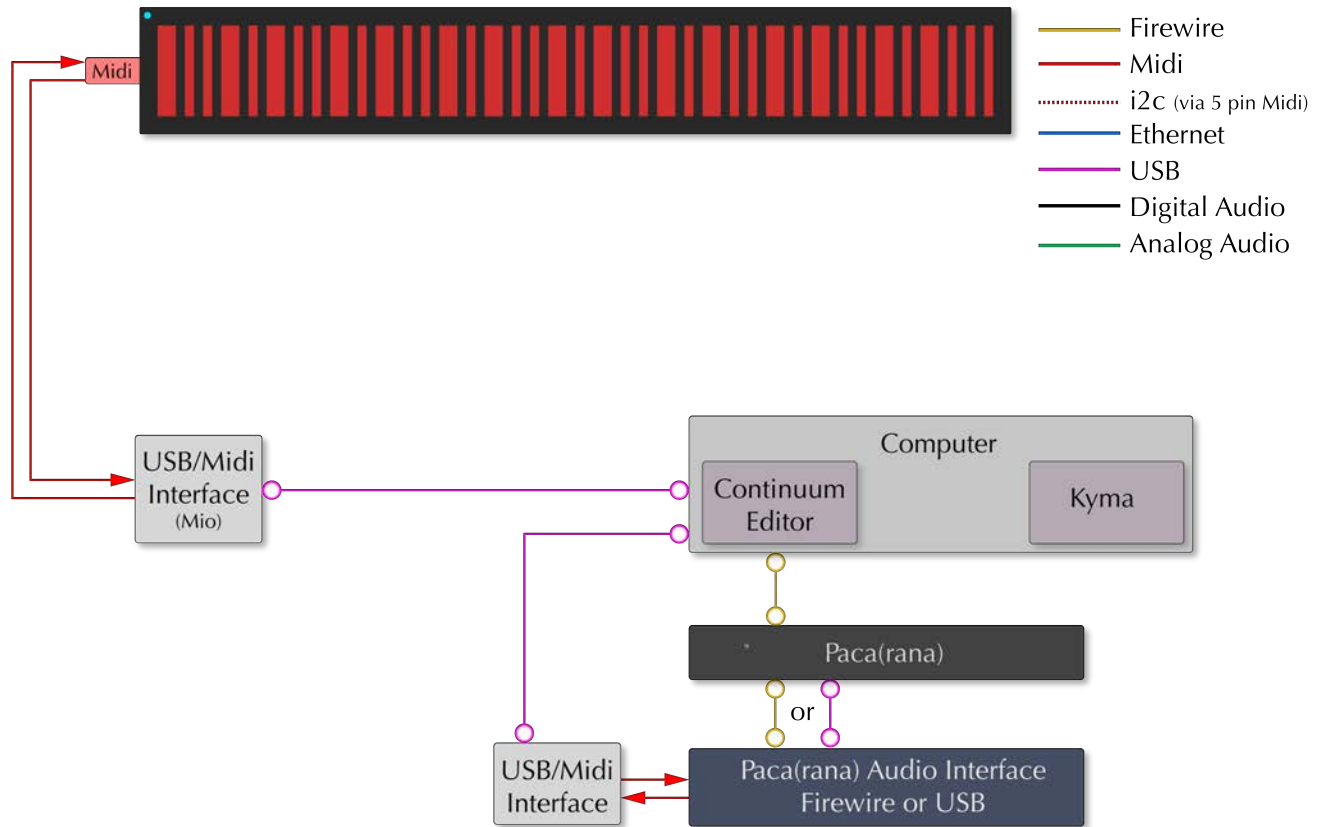
Kyma: A Midi connection to the Paca(rana) and Kyma running on the same computer as the Continuum Editor is established by using a USB Midi connection. In this case the "Midi and Globals" page this connection is labeled UM-1. See Section 10.10 for a necessary Kyma-specific configuration setting.

Paca(rana): A data connection to the Paca(rana) and the computer is established via Firewire.

Paca(rana) Audio Interface: A data connection to the Paca(rana) and the Interface is either Firewire or USB, depending on the interface.

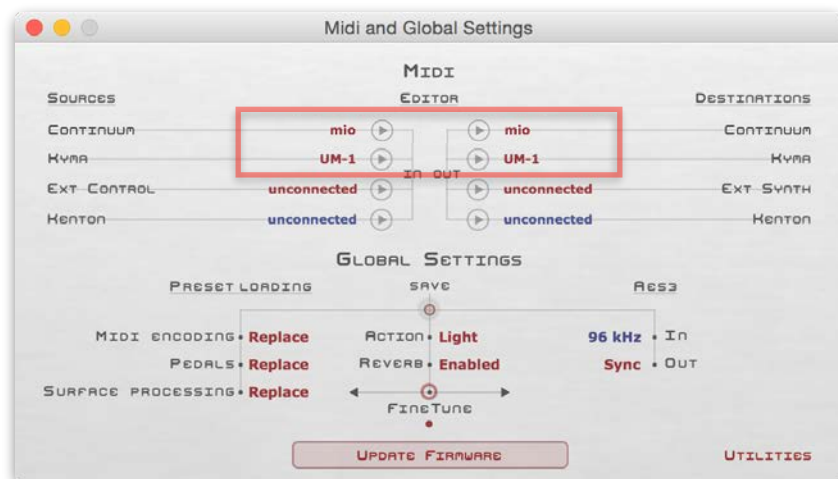## 12.12. Connecting Midi Keyboard, Continuum and Kyma (Mac)

Continuum Editor: Connections to the Editor on an external computer are made through the supplied iConnectivity Mio (or Midimate2) USB connection, which is auto-detected and shows up in the "Midi and Globals" page of the Editor**.**

Kyma: A Midi connection to the Paca(rana) and Kyma running on the same computer as the Continuum Editor is established by using Delora Software's Kyma Connect via a virtual Midi bus via ethernet called vPacarana. See Section 10.10 for a necessary Kyma-specific configuration setting.

Paca(rana): A data connection to the Paca(rana) and the computer is established via Firewire.

Paca(rana) Audio Interface: A data connection to the Paca(rana) and the Interface is either Firewire or USB, depending on the interface.

Midi Keyboard: A connection is made via Midi/USB, in this case labeled UM-1 in the Midi and Global Settings.

12.13. Connecting Midi Keyboard, Continuum and Kyma (PC)

Continuum Editor: Connections to the Editor on an external computer are made through the supplied iConnectivity Mio (or Midimate2) USB connection, which is auto-detected and shows up in the "Midi and Globals" page of the Editor.
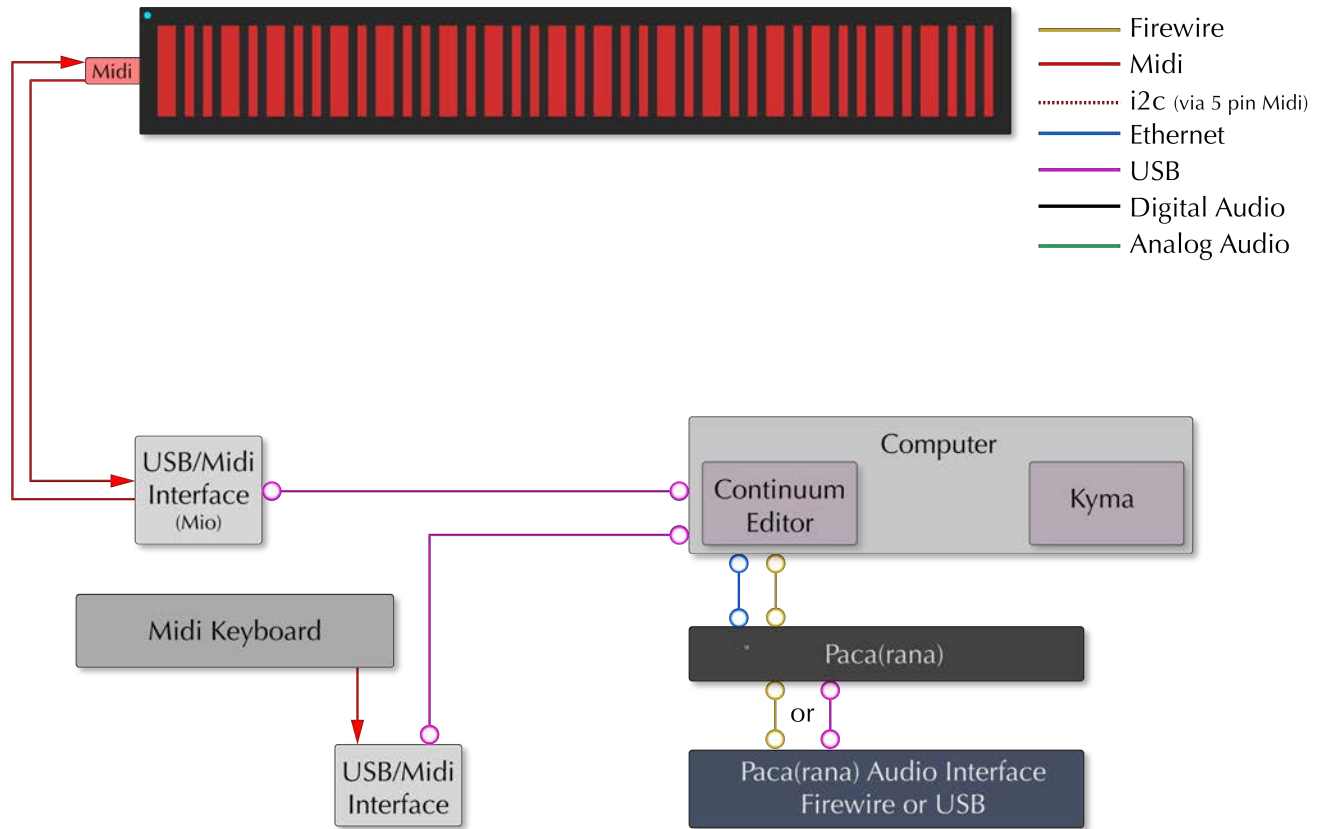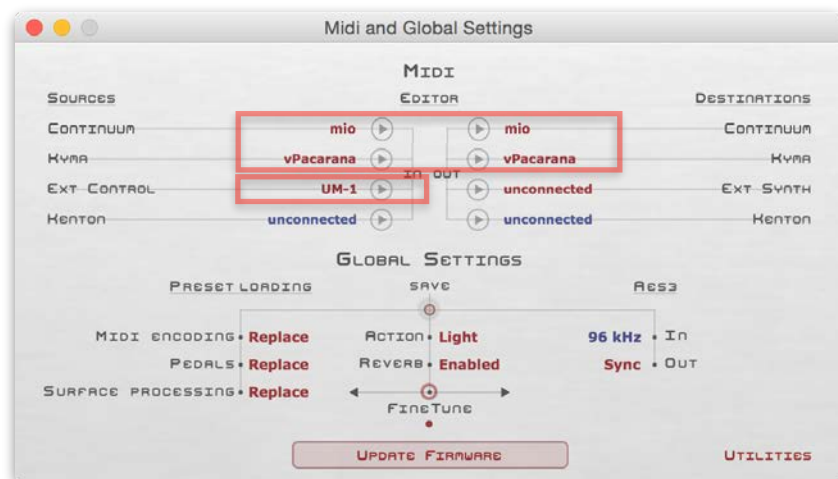
Kyma: A Midi connection to the Paca(rana) and Kyma running on the same computer as the Continuum Editor is established by using a USB Midi connection. In this case the "Midi and Globals" page this connection is labeled UM-1. See Section 10.10 for a necessary Kyma-specific configuration setting.
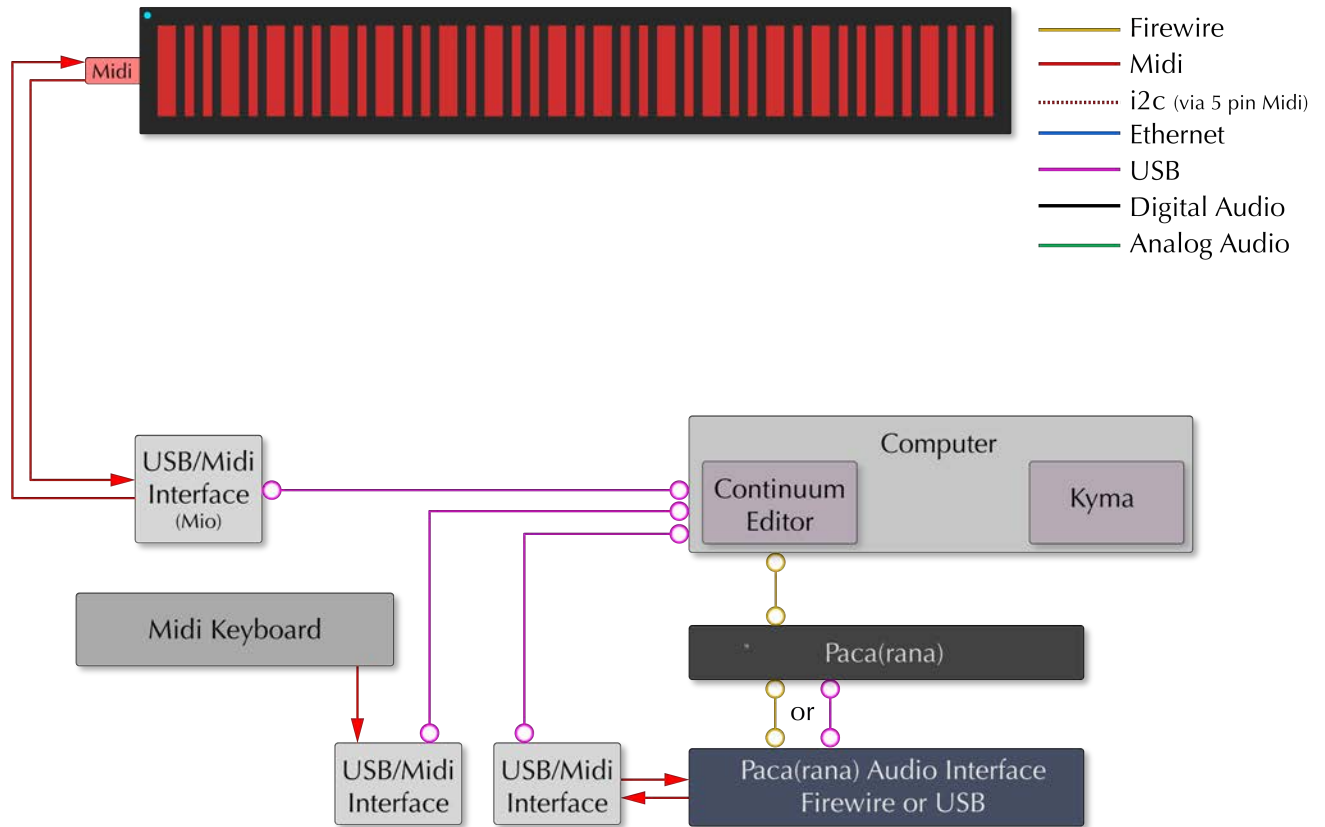
Paca(rana): A data connection to the Paca(rana) and the computer is established via Firewire.

Paca(rana) Audio Interface: A data connection to the Paca(rana) and the Interface is either Firewire or USB, depending on the interface.

Midi Keyboard: A connection is made via Midi/USB, in this case labeled Vmidi 1 in the Midi and Global Settings.

12.14. Connecting to External Midi Synthesizer
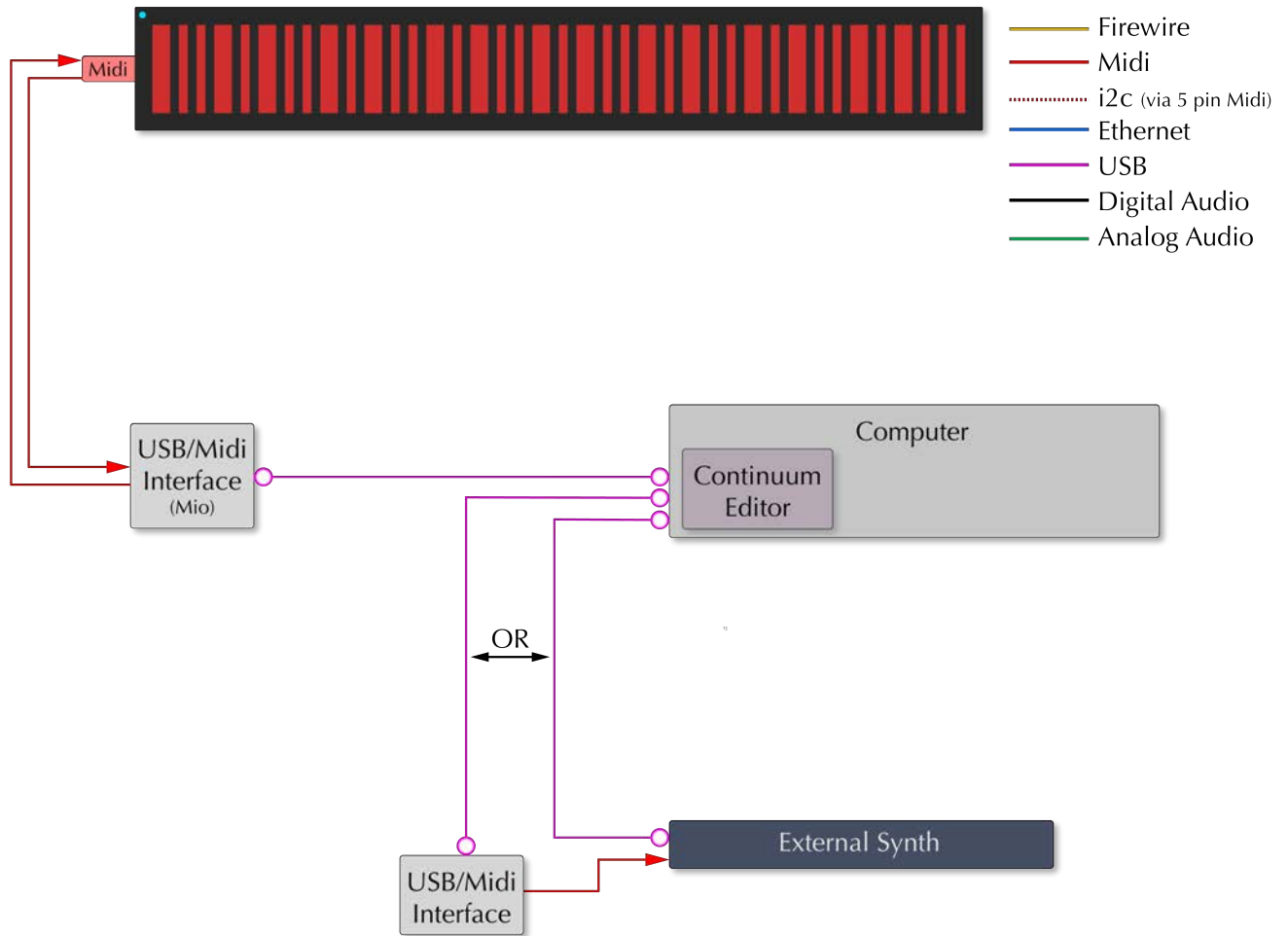
Continuum Editor: Connections to the Editor on an external computer are made through the supplied iConnectivity Mio (or Midimate2) USB connection, which is auto-detected and shows up in the "Midi and Globals" page of the Editor.

External Synth: A connection is made via Midi/USB, in this case labeled UM-1 in the Midi and Global Settings.

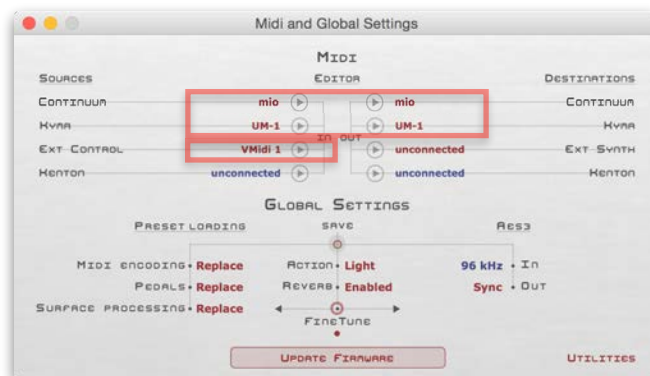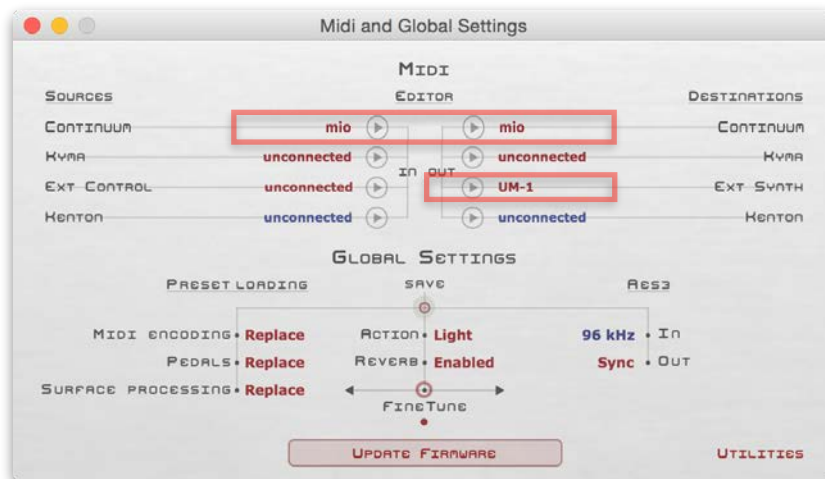## 12.15. Connecting a Kenton Controller with Computer
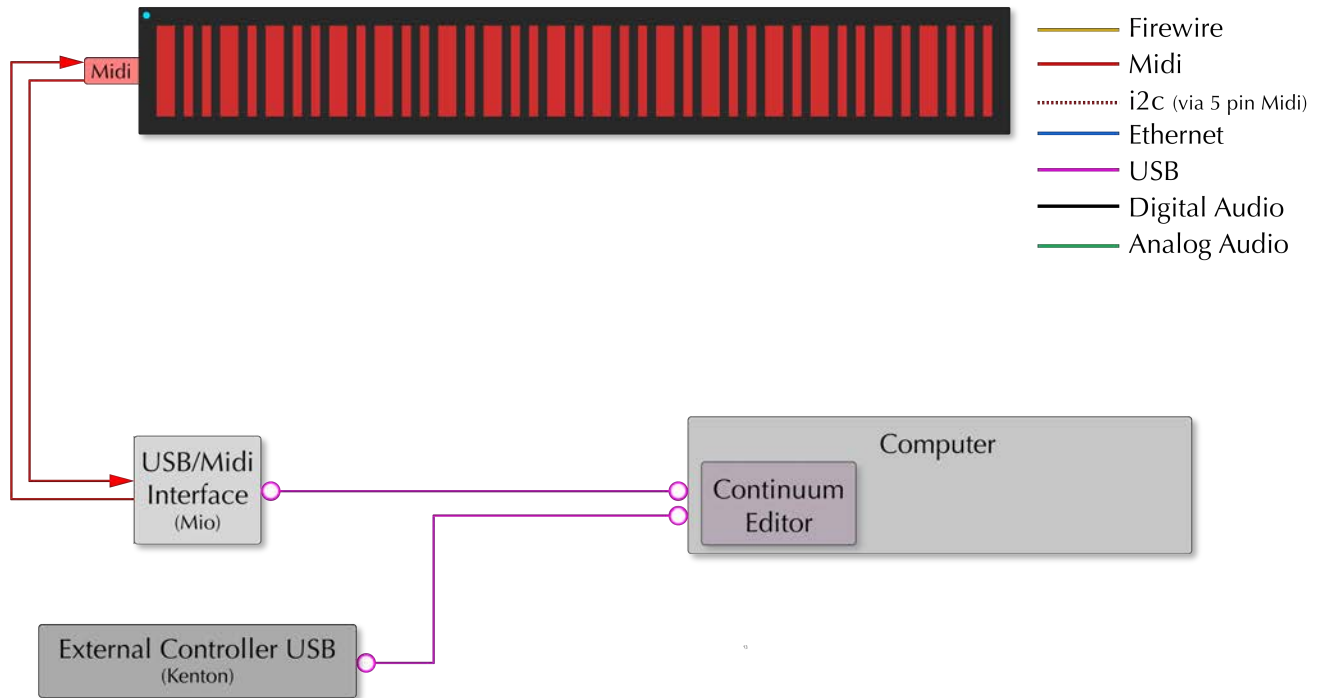
Continuum Editor: Connections to the Editor on an external computer are made through the supplied iConnectivity Mio (or Midimate2) USB connection, which is auto-detected and shows up in the "Midi and Globals" page of the Editor.

Kenton Controller: A connection is made via USB, and the Kenton is auto-recognized as shown in the Midi and Global Settings.
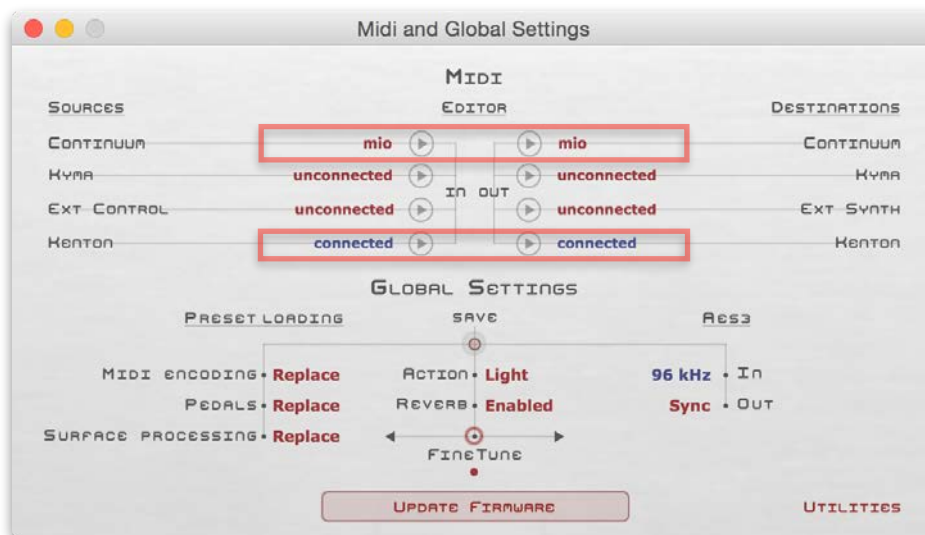
12.16. Connecting a Kenton Controller Standalone (No Computer)
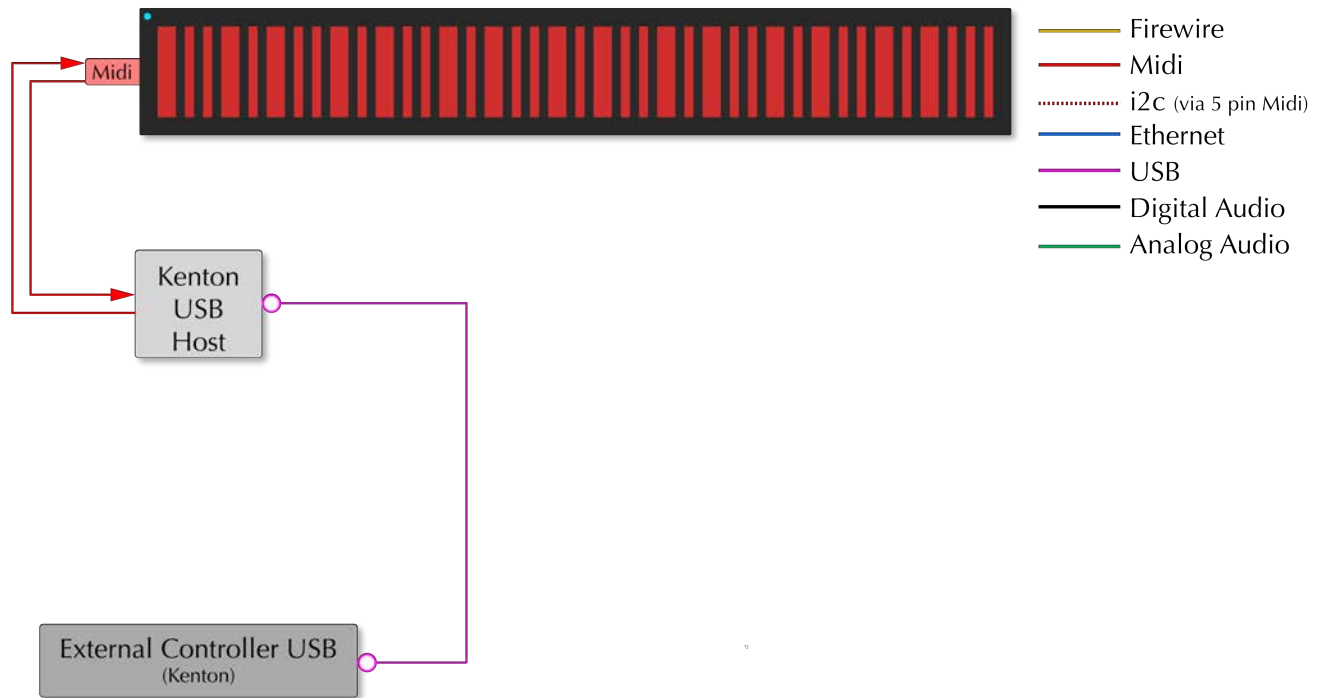
Kenton USB Host: A bidirectional Midi connection is made between the Kenton Midi Host and the Continuum.

Kenton Controller: A connection is made via USB to the Kenton USB Host.

12.17. Connecting a BeatStep with Computer
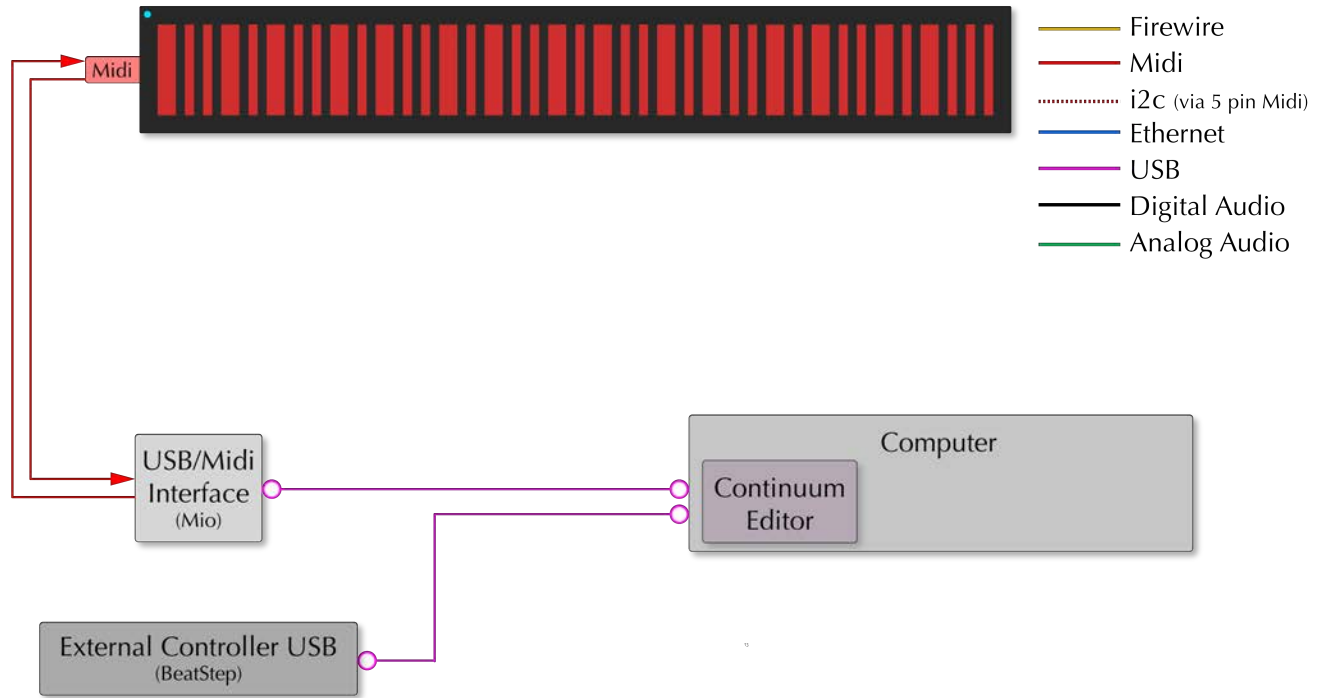
Continuum Editor: Connections to the Editor on an external computer are made through the supplied iConnectivity Mio (or Midimate2) USB connection, which is auto-detected and shows up in the Midi and Globals page of the Editor.

BeatStep Controller: A connection is made via USB, and "Arturia BeatStep" is chosen as the Ext Control setting in Midi and Global Settings.
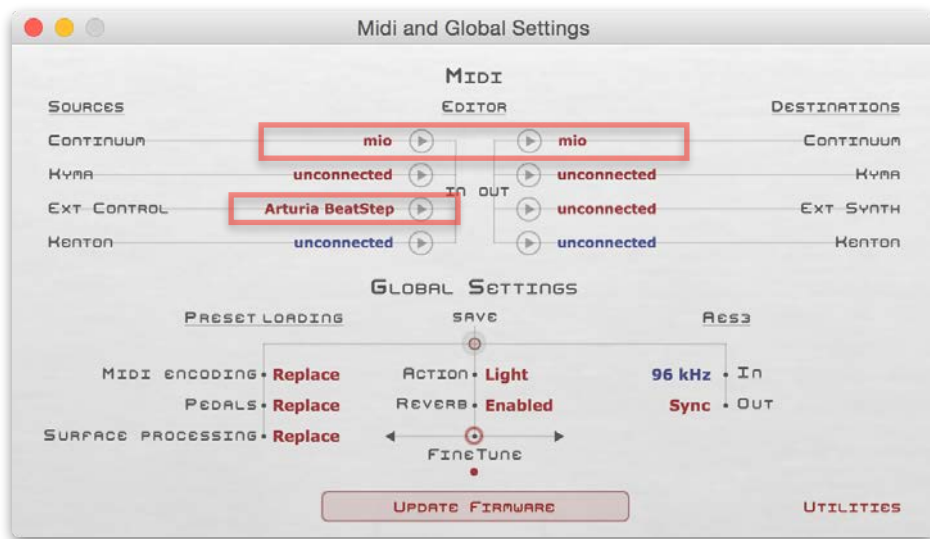
12.18. Connecting a BeatStep Standalone (No Computer)
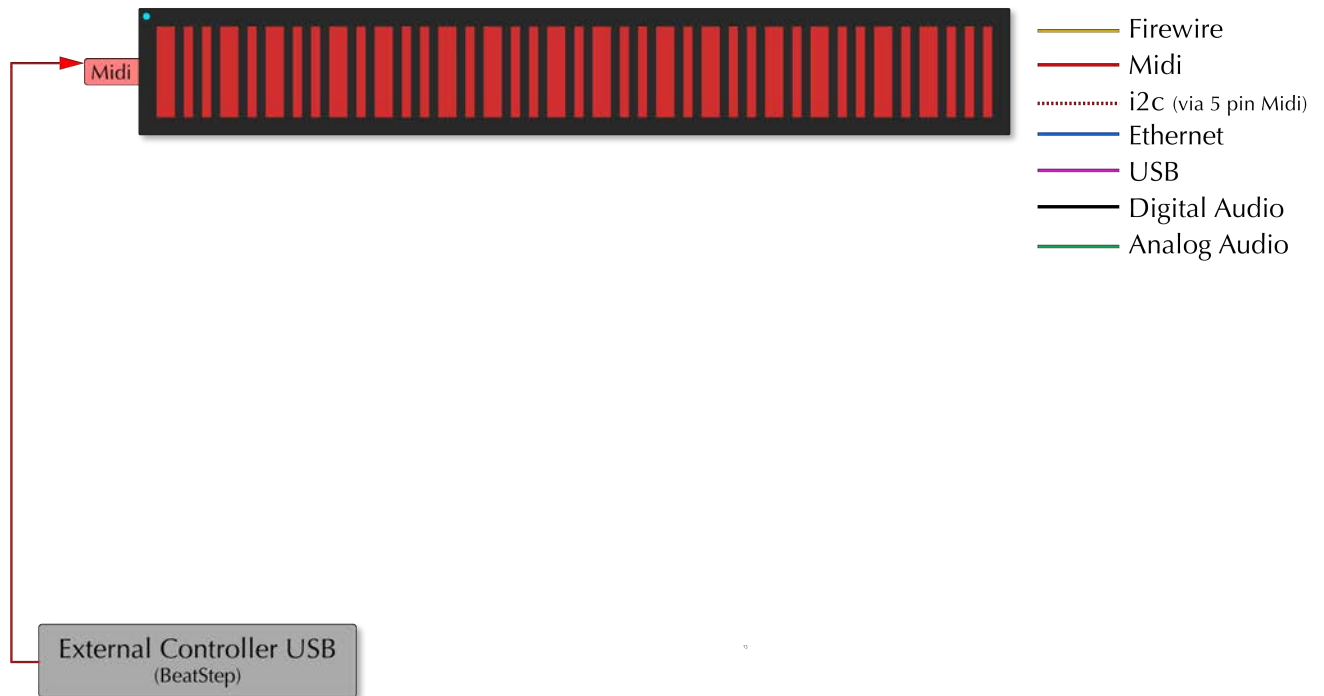
BeatStep Controller: A connection is made via the BeatStep's Midi Out. Note that in this configuration the BeatStep will require external USB power.

13. Hardware Maintenance

13.1. 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.

13.2. 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 marked 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, sometimes 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.

3. Slide the fingers along the edge while constantly bottoming out to about here.

4. Repeat steps 2 to 3 until centre of black surface aligns with dot.

2. Press down with multiple fingers along the edge of the surface around here (bottom out).

black surface centre

1. Frame dot mark does not align with centre of black playing surface "key".
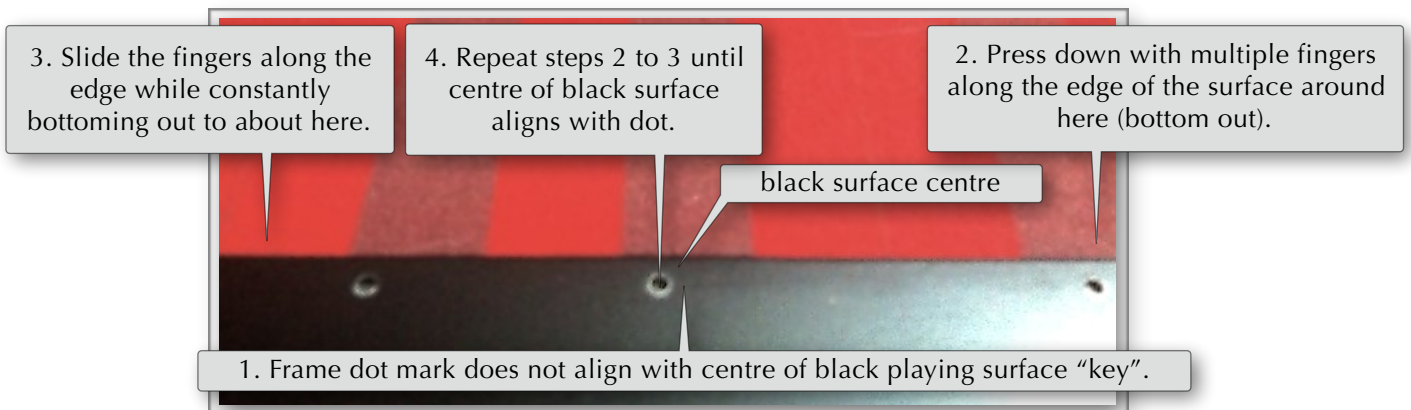
Depending on the model of your hardware, your Continuum Fingerboard may have screws on the sides of the top frame, as shown in the images below. A half-size of this design will have 6 such screws, a full-size will have 8. Loosening these screws by **a single turn** may make it easier to adjust the surface. After your have done the adjustment, tighten the screws with **a single turn** — do not over-tighten the screws.

If you have trouble getting good surface alignment, 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.

13.3. Hardware Problems

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

If you have trouble with your USB-Midi cable:
(1) Try resetting the USB-Midi cable by unplugging and replugging its USB connector.
(2) If you continue to have problems, try connecting your USB-Midi cable through a **powered USB hub**.

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.

Discard Calibration:
Discard the calibration, then follow the calibration procedure described in Section 7.

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 10.19. Use Section 10 to guide you in reconfiguring your Midi encoding.

Perform the Factory Calibration:
Please contact technical support before you resort to this. The Factory Calibration is described in Section 13.7.

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.

13.4. 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 10.19) selected.

13.5. 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.

13.6. 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."

13.7. Factory Calibration

At the end of a Continuum Fingerboard's manufacturing process, a Factory Calibration is done. Factory Calibration is a one-time procedure, and need not be repeated. Continuum Fingerboard owners need to know how to refine calibration and discard calibration (Section 7), but this three-step Factory Calibration is only described here for completeness.

1. Make sure nothing is pressing on the Continuum Fingerboard (no fingers or other objects on the playing surface or frame). Press and release the Red Button, then touch at "Calibrate", then "120+", then "7". Now the Continuum's LED should shine bright white, and (if the Continuum Editor is running) the Editor will display a special message for Factory Calibration.

2. Slowly drag the back of a fingernail (to minimize friction) horizontally across the whole span of the playing surface (from one end all the way to the other) several times, using a forte finger pressure. Do this a few times next to the front edge of the playing surface, and also next to the back edge of the playing surface. Be sure 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.

13.8. 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.

14. Performance Controller Assignments

Midi data from channels 14, 15, and 16 sent to the Continuum Fingerboard has special functionality. This functionality allows external Midi controller of performance parameters that are normally available as pedal performance controls on the Continuum.

14.1. Sending Midi Performance Values to the Continuum Fingerboard

If you use a third-party device (or software) to supply performance controller Midi values to the Continuum Fingerboard, you have the choice of using relative or absolute encoding.

Use Midi channel 14 for relative encoding. Send a pedal cc from the table below on channel 14, and use data value 63 to decrease the data value by 1, or 65 to increase by one. The relative change will be DataValue-64. If you send only values 63 and 65, the Continuum will automatically implement an acceleration algorithm for repeated decrements or increments. This feature is used with Arturia BeatStep to work around bugs in the BeatStep's native acceleration (for more information on the BeatStep, see see Sections 6.7, 12.17 and 12.18).

Use Midi channel 15 for absolute data encoding. Send a pedal cc from the table below on channel 15, with data value 0 to 127. You can either connect your device directly to the Continuum Fingerboard's Midi In jack, or, if the Continuum Editor is running, connect via the "Ext Control" in the "Midi and Global Settings" (see Section 12 for examples).

14.2. Receiving Midi Performance values from the Continuum Fingerboard

If you want third-party software (or a device) to receive performance pedal values from the Continuum Fingerboard, connect it via the "Ext Synth" connection in "Midi and Global Settings" (see Section 12). The performance pedals will be encoded with the cc numbers from the table below on channel 16, and the data value will be absolute from 0 to 127.

14.3. Assignments

Channel 14, 15, 16	
cc 8 Octave Shift	Shift the playing surface by one octave down (value 48) or one octave up (value 72), or no octave shift (value 60). Regular switch pedals, as well as the Tri-Value pedal, can generate cc 8. The shift values generated by may be configured to shift a different number of octaves (see cc 54 in Section 15.1, and Section 10.19).
cc 9 Mono Switch	The Mono Switch enables single-note lines when Polyphony is greater than 1, for notes that are within the Mono Interval (see cc 48 below, and Sections 6.3 and 10.13).
cc 10 Fine Tune	Fine Tune control, in cents. 64 is normal, 63 is one cent flat, 65 is one cent sharp.
cc 12 i cc 13 ii cc 14 iii	The Continuum Fingerboard's internal sound parameters "i", "ii", and "iii". These may also be set using the Overlay Strip's i, ii, iii.

Channel 14, 15, 16	
cc 15 iv	The Continuum Fingerboard's internal sound parameter "iv".
cc 16 Gen1 cc 17 Gen2	Gen1 and Gen2 are used with the EaganMatrix. Gen1 also is used to control release time for certain Specialty Sounds.
cc 18 Gain	Output gain level of the internal sound. See Section 10.1.
cc 19 AES Input Level	Level for AES input.
cc 20 R1	Recirculator control R1, 0 (minimum) to 127 (maximum). The EaganMatrix's Master Section can provide an offset to the cc 20 value, scaled 0..1.
cc 21 R2	Recirculator control R2, 0 (minimum) to 127 (maximum). The EaganMatrix's Master Section can provide an offset to the cc 21 value, scaled 0..1.
cc 22 R3	Recirculator control R3, 0 (minimum) to 127 (maximum). The EaganMatrix's Master Section can provide an offset to the cc 22 value, scaled 0..1.
cc 23 R4	Recirculator control R4, 0 (minimum) to 127 (maximum). The EaganMatrix's Master Section can provide an offset to the cc 23 value, scaled 0..1.
cc 24 Recirculator Mix	Mix between recirculator output and dry signal. 0 = 100% dry, 127 = 100% recirculator. The EaganMatrix's Master Section can provide an offset to the cc 24 value, scaled 0..1.
cc 25 Round Rate	Sets the rate for the Continuum Fingerboard's finger position rounding feature (see Sections 6.4 and 10.15).
cc 28 Round Initial	Round initial finger positions to nearest half step (or nearest point in the current Pitch Table).
cc 31 Advance	Advance to next User Preset (value 127, also called "Full Advance"), or to next preset within a Combination Preset (value 64, also called "Half Advance"; see Section 8.9). *The ideal Advance pedal is a Tri-Value pedal, which does both Full Advance and Half Advance (see Section 6.5). A Yamaha switch pedal by default does only Full Advance, but can be changed to Half Advance by setting Pedal Max to 64 (see Section 10.18).*
cc 65 Equal	This is used to temporarily disable rounding, and to temporarily ignore the selected Pitch Table. Value 0 ignores rounding; value 64 does the rounding specified by the preset; value 127 does rounding but uses the Equal scale (ignores the preset's Pitch Table).
cc 64 Sustain cc 66 Sostenuto 1 cc 69 Sostenuto 2	The Continuum Fingerboard supports 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.

15. Configuration Controller Assignments

15.1. Load, Store, and List Presets

Channel 16		
cc 80 (lsb) cc 81 (msb) Load Preset	Load User Preset Slot (Section 8.6) with values 1-16. Load System Preset with values 17-511 (add 17 to system preset #), The 7 LSBs (cc 80) *must always be* followed by the MSBs (cc 81).	1-16 Load User Preset, 17-511 System Preset
cc 109 Store Config	Store current configuration and store global settings to flash.	8 store config
cc 57 (lsb) cc 58 (msb) Store Preset	Store User Preset Slot (Section 8.6) with values 1-16. Store System Preset with values 17-511 (*for Editor use only*). The 7 LSBs (cc 57) *must always be* followed by the MSBs (cc 58).	1-16 Store User Preset, 17-511 System Presets
cc 109 Demo Setup	Load 16 demo presets into User Preset Slots, and transmit names of the 16 demo presets using cc 56 Text (see below).	39 demo setup
cc 109 Transmit Config	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
cc 109 Transmit Names	Transmit names of 16 User Preset Slots and all System Presets, using cc 56 Text (see below). Category names will be included.	32 transmit names
cc 56 Text	Identifies the Ascii text that follows; included in the Continuum Fingerboard's response to Transmit Config, Transmit Updates, and Transmit Names (see above). Ascii data is transmitted as channel 16 channel pressure, terminated by value 127. Finally, if text is a preset name, cc 57 and 58 (see above) identify the preset number.	0 preset name, 1 preset text, 8 category name

15.2. Midi Device Compatibility

Channel 16		
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 keyboard and Continuum.	1 to activate, 0 is default
cc 109 Low Power Bluetooth	Use 5% of Midi Data Rate, for Low Power Bluetooth Midi. This data rate is much too slow for Continuum playing, but convenient for configuration with wireless Continuum Remote apps.	38 5% Midi rate, 37 8% Midi rate, 36 100% Midi rate

15.3. X, Y, and Z Coding

Channel 16		
cc 44￼Middle C	Midi note number corresponding to middle C position.	0-127￼60 is default
cc 54￼Octave Shift￼Configuration	Midi note number corresponding to middle C position while the Octave Shift is active. This value and 60 minus this value will be encoded in the Octave Shift (cc 8) if the Tri-Value pedal is used.	0-127,￼48 is -1 octave,￼72 is +1 octave
cc 40￼X Bend Range	Number of half steps for Midi Pitch Bends.	1-96 bend range
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. Controller assignment 127 will transmit using cc 74, without shelving at the extremes of the Y range.	1-127,￼74 is default,￼0 no output
cc 42￼Z Controller￼Assignment	Controller assignment for finger Z position (pressure). Special value 127 selects MPE encoding: Channel Pressure for Z, ch 1 cc 127 for polyphony, ch 2 RPN 0 for pitch bend range (see Section 10.9). No value is transmitted for Z if the controller assignment is 0. Value 70 selects 14-bit MPE Encoding (see Section 10.9 for details).	1-69 to select Z cc,￼70 14-bit MPE,￼127 MPE (default),￼0 no output
cc 43, bits 0-2￼Midi Note￼Processing	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 encodes Note On velocity computed by EaganMatrix formula V. Value 3 avoids transmitting any Note On, Note Off, or Pitch Bend messages. Value 4 makes the Continuum act as a 3-d ribbon controller, providing pitch bends for an external Midi keyboard. Value 5 always uses 60 for the Midi key number, and all bends are referenced from Middle C. Value 6 enables special Kyma processing. See Section 10.10 for details.	0 constant 127,￼1 velocity,￼2 formula,￼3 no note output,￼4 External Note mode,￼5 Ethervox mode,￼6 Kyma mode

15.4. Rounding and Pitch Tables

See Section 14.3 for the Round Rate controller. The following configuration affects how Round Rate is used.

Channel 16		
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 Pitch￼Table	Select Pitch Table for Round Initial, Round Rate, and surface pitch warping.￼60..71 for Just tuning with C..B tonic centre.￼1..50 for n-tone Equal tuning, with n divisions per octave.￼80..87 for a user-defined downloadable Pitch Tables (see Section 6.4)	1-50 n-tone 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

15.5. Polyphony, Routing, and Split

Channel 16		
cc 39 Polyphony	Base polyphony, and two flags: Allow Increased Sample Computation Rate and Allow Expanded Polyphony.	1-16, +32 Increased Rate, +64 Allow Expand Poly
cc 49, bits 2-4 Channel Priority	Select how new notes get assigned to Midi channels: Oldest (assign the new note to the Least Recently Used channel), Same (assign to channel that played the same pitch), or Lowest (assign to the lowest channel number that is available). 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 10.6).	0 Oldest, 1 Same, 2 Lowest, 3-6 High 1 to 4
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, 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, bit 5 for CVC
cc 45 Split Point	Note number for split point.	0-127, 60 is default
cc 43, bits 3-5 Split Mode	Select split mode (see Section 10.12). An alternative split mechanism, Multi-Split, is described in Section 10.12.	0 off, 1 polyphonic, 2,3 single below/above, 4,5 internal b/a

15.6. Quarter Inch Pedals

Channel 16		
cc 52 Pedal1 Jack	Midi controller assignment for Pedal 1 Jack.	See Section 14, 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 Pedal 2 Jack.	See Section 14ß, 66 is default
cc 78 Pedal2 Min	Minimum data value for Pedal 2.	0-127, 0 is default
cc 79 Pedal2 Max	Maximum data value for Pedal 2.	0-127, 127 is default

15.7. Mono Function

Channel 16		
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 6.3 and Section 10.13.	0 Portamento (default), 1 Legato Z, 2 Retrigger Z, 3 Legato T, 4,5 Retrig 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 14.3) can be used to enable and disable effect of the Mono Interval during a performance.	0 disables this, 1-96 interval, 0 is default

15.8. Firmware Version and CVC Serial Number

Channel 16		
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.	0-127
cc 103	Low 7 bits of firmware version.	0-127
cc 104 CVC Serial	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	Bits 13-7 of 16-bit CVC serial number.	0-127 medium bits serial number
cc 106	Bits 6-0 of 16-bit CVC serial number.	0-127 low bits serial number

15.9. Other Configuration Controller Assignments

Channel 16		
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 disabled, 1-20 Midi program
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 91 Tweak	When the Continuum Editor is running, this will modify (tweak) the mouseover parameter in the Editor.	0-127
cc 109 Calibration	Refine calibration, and discard calibration (see Section 7).	35 refine, 34 discard