

Continuum Fingerboard

User's Guide

For Continuum Fingerboards with FireWire
July 6, 2008 – Firmware 2.04 and 2.05

1 Overview

The Continuum Fingerboard tracks the position and pressure of fingers on its playing surface, and its internal computer encodes the finger information into MIDI data streams. The Continuum Fingerboard has two methods for transmitting MIDI data streams: 1394 FireWire and traditional MIDI cable. The Continuum Fingerboard can also produce control voltages via the Continuum Voltage Converter (CVC).

The traditional MIDI cable can connect to any MIDI device, such as a synthesizer or computer.

1394 FireWire can communicate MIDI data to a host computer using a proprietary asynchronous communication protocol.

1394 FireWire can also communicate directly with Symbolic Sound's Cabybara signal processor, without going through a host computer. Version 2.04 is compatible with Symbolic Sound's Flame; version 2.05 is *only* for use with Symbolic Sound's beta release of the AVC-Flame.

1.1 MIDI Encoding

The Continuum Fingerboard assigns each finger on the playing surface its own MIDI channel. By default it tracks 8 fingers, each finger using discrete MIDI channels 1-8. It may be configured to track between 1 and up to 16 fingers. 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 extended using Octave Shift, as described in Section 3. The default Pitch Bend range is two octaves. The default encoding for finger pressure uses MIDI controller 11 (Expression), and the default encoding for front-to-back uses MIDI controller 74 (Brightness).

Other configuration options provide alternative encoding of finger pressure (as Channel Pressure, or any continuous controller) and alternative continuous controllers for encoding the front-to-back position of each finger. Also, you can configure the Continuum Fingerboard to reset Pitch Bend between notes.

For more details of the MIDI encoding and for configuration changes you can make using the Continuum Fingerboard's MIDI In jack, please see the MIDI topic at www.HakenAudio.com.

Configuration changes you make using the Continuum Fingerboard's playing surface in conjunction with the RED button are described in Section 3.

1.2 Kyma Encoding

If you use Kyma, the polyphony of the Continuum Fingerboard depends on the polyphony of your Kyma Sound. The maximum polyphony will be 16. Each finger's position and pressure is available in standard Kyma MIDI-event values: !KeyPitch or !KeyNumber (right-to-left position), !KeyTimbre (front-to-back position), and !KeyVelocity (finger pressure). These values continually change as the fingers move. Note that !KeyPitch and !KeyNumber are MIDI note numbers, with fractional values to indicate exact finger position.

It is sometimes desirable to smooth !KeyVelocity (finger pressure) when you use it in Kyma. In many synthesis algorithms you just type “!KeyVelocity smoothed” in a hot parameter field. In some situations this will result in an audible 1kHz noise due to the evaluation rate for hot parameters. You can avoid the problem by smoothing at full sample rate: use a Constant sound with value !KeyVelocity, feed that into a low pass filter Sound with cutoff at or below 250 Hz (equivalently 4 ms or longer), and then feed that into a Product Sound that scales your sample stream.

To get the quickest real-time response from Kyma, choose the minimum Overall System Delay (3 ms) in the Kyma preferences.

To implement keyboard splits, use the LowRange and HighRange fields in your MidiVoice Sounds.

1.3 Connection to Symbolic Sound Capybara

If you use Kyma, connect to the Capybara with 1394 Firewire. Disconnect any traditional MIDI connections between the Continuum Fingerboard and the Capybara. The Kyma Firewire interface has two FireWire plugs; we suggest you use one plug to connect to the Continuum Fingerboard, and the other plug to connect to your Mac or PC.

1.4 Windows Found New Hardware Wizard

The Continuum Fingerboard communicates directly with the Kyma 1394 Firewire interface. If you are using Kyma on a PC, Windows should ignore the Continuum Fingerboard; Windows is not involved in the communication between the Continuum Fingerboard and Kyma. Windows may detect the Continuum Fingerboard on 1394 Firewire and put up a Found New Hardware wizard. If so, keep clicking “Next” until it gives you the option to “Disable this device.” Choose that option (which will make Windows ignore the Continuum Fingerboard, but will not affect the Continuum Fingerboard in any other way) and finish. After this procedure, you should no longer see a Found New Hardware wizard when you plug in or turn on your Continuum Fingerboard.

1.5 Hardware Specifications

	Full Size	Half Size
Pitch Range	Nearly 8 octaves (9350 cents)	Nearly 4 octaves (4610 cents)
Pitch Resolution	1 cent	1 cent
Scan Interval	1.33 ms	1.33 ms
Size	135 19 7.5 cm (54 7.5 3 in)	71 19 7.5 cm (28.4 7.5 3 in)
Flight Case Size	150 26.5 20 cm (59 10.5 8 in)	86 26.5 20 cm (34 10.5 8 in)
Lightweight Case Size	150 28 16.5 cm (59 11 6.5 in)	86 28 16.5 cm (34 11 6.5 in)
Weight	10.2 kg (22.5 lbs)	7.3 kg (16 lbs)
with Heavy Case	23.3 kg (52 lbs)	14.8 kg (33 lbs)
with Regular Case	17 kg (38 lbs)	11.2 kg (25 lbs)
Power	50 watts, 110 or 220 vac	40 watts, 110 or 220 vac
Interface	1394 FireWire and Traditional MIDI	1394 FireWire and Traditional MIDI

1.6 Turning On the Continuum Fingerboard

The Continuum Fingerboard should be placed on a solid stand or table. The stand or table should not appreciably move when vibrato or other finger motions occur on the playing surface.

When you plug in the Continuum Fingerboard and turn it on, the LEDs should light within four seconds. If they don't, please turn it off and check the fuse. If you repeatedly blow fuses, please contact technical support; this indicates a serious problem.

The Continuum Fingerboard will be warm to the touch if it has been turned on for a while. This is normal and does not indicate a problem. If it is too hot to touch, this indicates a serious problem; please turn it off and contact technical support.

When you first receive your Continuum Fingerboard, you must follow the procedure in Section 2 of this manual. After you complete the calibration, you will be ready to connect your Continuum Fingerboard to your synthesizer.

After you connect your Continuum Fingerboard to your synthesizer, you will need to configure both your Continuum Fingerboard and your synthesizer. If you are using Kyma, all you need to do is load a Sound that is set up for Continuum Fingerboard or Keyboard input. If you are using a MIDI synthesizer, these are the most important configuration options:

- (1) Configure your synthesizer to receive on multiple MIDI channels, configure the same timbre on all the channels, and configure the Continuum Fingerboard's polyphony to match the synthesizer.
- (2) Configure your synthesizer for maximum pitch bend range on all channels, and configure a matching pitch bend range on your Continuum Fingerboard. 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. Please contact Haken Audio if you have trouble.

1.7 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, remember that a traditional keyboard is velocity sensitive. A single value is transmitted from the speed of the key movement.

In contrast, the Continuum Fingerboard is pressure sensitive. It continually outputs a stream of pressure values until the note is terminated. It is unusual to hit the hard stop (or "bottom out") except for the very loudest notes. This distance from zero pressure to maximum pressure is small, yet offers an extremely wide range of dynamic possibilities. The lighter the touch you master on the Continuum Fingerboard, the greater the expressive possibilities it will offer you. This is a very important thing to remember. 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.

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.

•

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; my favorite is to imitate Clara Rockmore playing Rachmaninoff on the Theremin. When you start playing chords, start simple and listen to the beats adjust as you roll your fingers on the playing surface. Try playing drone tones and add a melody. Practice just intonation and alternate tunings.

Chords containing half-step intervals present a particular challenge. When you place fingers closely together (less than 150 cents apart) on the playing surface, the Continuum Fingerboard can have trouble resolving the two fingers. This may result in a smaller pitch interval than you expect, or it may result in a single finger (not two fingers) being detected. With practice you can reliably play half-step intervals. It may help to place each finger at a different front-back position, or to use Round Initial Finger Positions (see below), or to define a custom tuning that repeats the same pitch range twice on the playing surface or extends the width of each octave (see tuning discussion at www.HakenAudio.com).

If playing chords with smaller than 100 cent intervals is of interest to you, and if you have a 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.

Additional performance controls are available from the MIDI In and 1/4" jacks. The Continuum has support for Sustain Pedal and Sostenuto Pedal inputs. For details, please see the MIDI topic at www.HakenAudio.com.

1.8 Designing Sounds for the Continuum Fingerboard

The Continuum Fingerboard can be used to control a wide variety of sound synthesis algorithms. Please consider the following suggestions when selecting or designing sounds to be used with the Continuum Fingerboard.

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.

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

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. 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.

Use synthesis algorithms that have timbre changes associated with loudness changes. Some sampling synthesizers change only the volume as the performer's finger pressure changes during a note. This limits

the apparent dynamic range and expressive possibilities available to the performer. Most acoustic instruments change their timbre as the volume changes. Keep this in account as you design your Continuum Fingerboard sounds.

Make good use of the front-back 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.

1.9 Sustain Pedal, Sostenuto Pedal, Instant Round, Octave Toggle

The Continuum Fingerboard has support for MIDI sustain and two sostenuto pedals. These pedals may be switches (values 0 or 127) or continuous (all values between 0 and 127). A continuous sustain or sostenuto pedal allows you to set the sustain level, and allows you to swell or fade the sustained notes.

The Continuum Fingerboard also has support for an Instant Round switch, an Octave Toggle switch, and a Red Switch controller.

For more details, please see the MIDI In topic at www.HakenAudio.com.

1.10 Quarter Inch Input Jacks

Some Continuum Fingerboards have two quarter inch input jacks in place of the MIDI Thru connector. The quarter inch input jacks have been tested with Yamaha FC4, FC5, and FC7 pedals. Using a quarter inch jack is exactly equivalent to sending the corresponding MIDI controller value to the Continuum Fingerboard's MIDI In on channel 16. By default, jack 1 corresponds to the Sustain Pedal controller (controller 64) and jack 2 corresponds to Sostenuto Pedal (controller 66). Section 2.2 describes an optional calibration procedure for the quarter inch jacks, and section 3.12 describes how to change the pedal assignments for the jacks.

2 Calibration

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

2.1 Playing Surface Calibration

To calibrate follow this three-step procedure:

- (1) For this first step, make sure your Continuum Fingerboard is powered on, and verify nothing is pressing on the Continuum Fingerboard (no fingers or other objects on the playing surface or frame). Hold in the both the RED and GREEN buttons for 10 seconds (a long time!), and, while you hold the buttons in, watch the RED and GREEN LEDs. The flicker pattern on the LEDs will change to indicate you have held the buttons long enough; then you can release the RED and GREEN buttons. The RED LED and GREEN LED will stop flashing.
- (2) Slowly run a fingertip up horizontally across the whole span of the playing surface (from one end all the way to the other), first next to the front edge of the playing surface, then next to the back edge of the playing surface. You do not need to exert an excessive force, but enough to press the control

surface all the way down. This will set the maximum pressure for all the sensors in the Continuum Fingerboard's playing 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 both the RED and GREEN buttons at the same time, for about 2 seconds. While you are pressing both buttons, the RED LED and GREEN LED make a flicker pattern. After you release the buttons, the RED LED and GREEN LED will stay on solid.

Step 3 may be repeated at any time, without repeating steps 1 and 2 first. We suggest you repeat step 3 after you have played your Continuum Fingerboard for a few hours, and once a day for the first few days. Doing this fine tunes the accuracy of the Continuum, compensating for DC shifts in sensor outputs.

2.2 Quarter Inch Input Jack Calibration (Optional)

Some Continuum Fingerboards have two quarter inch input jacks in place of the MIDI Thru connector. If your Continuum has such jacks, you have the option to calibrate them for your pedals. This calibration has no advantage for switch pedals, but it can be useful for optimizing the playing travel of a continuous pedal.

To calibrate the quarter inch jacks, add this to the Playing Surface Calibration procedure:

- Before step 1 of the procedure, make sure your pedals are plugged in. The calibration will be specific to these particular pedals.
- Before step 3 of the procedure, work your pedals through their full range a few times.

This calibration will be stored in the Continuum Fingerboard's permanent memory. You do not need to calibrate every time you turn on your Continuum Fingerboard, nor do you need to calibrate when you reassign your pedal functions (as described in Section 3.12). But you do need to repeat the calibration if you use different pedals, or if you change which pedal is plugged into which quarter inch jack.

3 Configuration from the Playing Surface

The Continuum Fingerboard may be configured by pressing the RED button and, before you release the button, also pressing on the playing surface. This configuration method is convenient for occasional configuration changes. (As an alternative, you might consider automating the configuration process using a third party configuration program or pedal board that can produce the MIDI NRPN messages described in the Midi topic at www.HakenAudio.com.)

You must calibrate your Continuum Fingerboard before you can make configuration changes.

3.1 Overlay Strips

The Continuum Fingerboard's Overlay Strips specify where to press for each configuration option available from the playing surface. Place the Upper Overlay Strip on the Continuum Fingerboard's frame *on the side farther away from you*, and line it up with the half-step pattern on the frame. The first heading on the Upper Overlay Strip is the "Polyphony:" heading. Place the Lower Overlay Strip on the Continuum Fingerboard's frame *on the side nearer to you*, and line it up with the half-step pattern on the frame. The first heading on the Lower Overlay Strip is the "Changes" heading. (If you decide you would like to permanently attach the Overlay Strips, you can do so using the double-sided tape on the back of each strip.)

The Upper Overlay Strip has the following options marked at each pitch:

	3E-4Eb	4E-5Eb	5E-6Eb	6F-7Eb
E		Front-Back: 1	Mono Intvl: Select+	Bend Reset: Off
F	Polyphony: 1	Front-Back: 2	Mono Intvl: Max	Bend Reset: On

F#/Gb	Polyphony: 2	Front-Back: 74	Split: Off	Inputs: Merge+
G	Polyphony: 4	Front-Back: Select+	Split: MonoL+	Inputs: Ext+
G#/Ab	Polyphony: 6	Pressure: 7	Split: MonoH+	Octave Shift: -2
A	Polyphony: 8	Pressure: 11	Split: Poly+	Octave Shift: -1
A#/Bb	Polyphony: 10	Pressure: Ch Pres	Round: Off	Octave Shift: 0
B	Bend Range: 12	Pressure: Select+	Round: Initial	Octave Shift: +1
C	Bend Range: 24	Mono Func: Legato	Round: Rate+	Octave Shift: +2
C#/Db	Bend Range: 36	Mono Func: Retrig	Round: Tuning+	
D	Bend Range: 48	Mono Func: Port	MIDI Velocity: z	
D#/Eb	Bend Range: 96	Mono Intvl: Off	MIDI Velocity: 127	

The Lower Overlay Strip has the following options marked at each pitch:

	3E-4Eb	4E-5Eb	5E-6Eb	6F-7Eb
E		Config Save: 10	Prog + Data: 110+	Prog + Data: 1
F	Changes: Lock	Config Load: 1	Prog + Data: 100+	Prog + Data: 2
F#/Gb	Changes: Unlock	Config Load: 2	Prog + Data: 90+	Prog + Data: 3
G	Config Save: 1	Config Load: 3	Prog + Data: 80+	Prog + Data: 4
G#/Ab	Config Save: 2	Config Load: 4	Prog + Data: 70+	Prog + Data: 5
A	Config Save: 3	Config Load: 5	Prog + Data: 60+	Prog + Data: 6
A#/Bb	Config Save: 4	Config Load: 6	Prog + Data: 50+	Prog + Data: 7
B	Config Save: 5	Config Load: 7	Prog + Data: 40+	Prog + Data: 8
C	Config Save: 6	Config Load: 8	Prog + Data: 30+	Prog + Data: 9
C#/Db	Config Save: 7	Config Load: 9	Prog + Data: 20+	
D	Config Save: 8	Config Load: 10	Prog + Data: 10+	
D#/Eb	Config Save: 9	Prog + Data: 120+	Prog + Data: 0	

If you attempt configuration options described below and nothing happens, it may be that the configuration is locked. When the Continuum Fingerboard is first turned on, the configuration is always unlocked; subsequently it can be locked with the Lock option or with Configuration Load and Lock. When the configuration is unlocked, the RED LED turns off when you first press the RED BUTTON and then starts flashing when you select a configuration option. If the configuration is locked, the RED LED will not start flashing and your configuration won't be changed. **To be certain that the configuration is unlocked,** hold in the RED button and press the edge of the playing surface *near the Lower Overlay Strip* at Unlock indicated on the strip. When you release the RED button, your configuration will be unlocked.

3.2 Polyphony

To select the polyphony (number of simultaneous notes tracked by the playing surface), hold in the RED button and press the edge of the playing surface *near the Upper Overlay Strip* at one of the Polyphony values indicated on the strip. When you release the RED button, your chosen polyphony will be in effect. The default polyphony is 8. (Polyphony greater than 10 can be set by sending configuration messages to the Continuum Fingerboard's MIDI In jack.)

3.3 Bend Range (x)

To select the pitch bend range, hold in the RED button and press the edge of the playing surface *near the Upper Overlay Strip* at one of the Bend Range values indicated on the strip. You should select the largest bend range available on your synthesizer, so that you can play the longest possible glissandi. Your choices are 12 half steps (1 octave), 24 half steps (2 octaves), 36 half steps (3 octaves), 48 half steps (4 octaves), or 96 half steps (8 octaves). 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 better than 1/100th half-step (1 cent) encoding accuracy even for a 96 half-step range. The default bend range is 24 half steps.

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.

3.4 Front-Back (y)

Choose the channel controller for encoding front-back position. The most common choices are: 1 for "modulation", 2 for "breath", or 74 for "brightness" (the default). You can select any other controller number by touching Select+, then, with the RED button still held in, touching the Program + Data Entry area on the Lower Overlay Strip.

3.5 Pressure (z)

Choose the encoding for finger pressure. The most common choices are: 7 for "channel volume", 11 for "expression" (the default), or Ch Pres to use channel pressure MIDI messages. You can select any channel controller by touching Select+, then, with the RED button still held in, touching the Program + Data Entry area on the Lower Overlay Strip.

3.6 Mono Function

Single-note lines can be performed with legato, retrigger, or portamento transitions between notes. The Mono Function lets you select what kind of transitions to use. The Mono Function selection only has an effect for single-note lines; you will hear the effect if you have Polyphony set to 1, or if you have a Mono Interval set, or if you are using one of the Mono split modes.

3.7 Mono Interval

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 Select+ and then touching the number of half steps in the Data Entry area. If you select Max for the Mono Interval, it will be set to 96 half steps. If you select Off, the Mono Interval function will be disabled.

If you configure a Mono Interval you can activate and deactivate that interval using the Mono Switch, as described in the MIDI Input section at www.HakenAudio.com.

3.8 Split

To split the playing surface into a monophonic low range and polyphonic high range, touch MonoL+ and then, with the RED button still held in, touch the split point. 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.

To split the playing surface into a monophonic high range and polyphonic low range, touch MonoH+ and then, with the RED button still held in, touch the split point. 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.

To split the playing surface two polyphonic ranges, touch Poly+ and then, with the RED button still held in, touch the split point. All pitches below the split point will be encoded on the first half of your MIDI channels, and the pitches above the split point will be encoded with the remaining MIDI channels.

To clear the split, touch Off.

Off

Touch Off to turn off all finger position rounding and make the Continuum Fingerboard encode exact pitch, pressure, and front-back position for each finger, from the time the finger first touches the playing surface until it is lifted.

Round Initial

Touch Initial to round the initial finger position. This aids a player in creating equal temperament pitches and intervals, or pitches and intervals in alternate tunings (see Tuning discussion below). Subsequent vibrato and glissando finger moves are interpreted at full micro-pitch resolution until a new note is sounded.

Round Rate

Touch Rate+ and then, with the RED button still held in, touch the Program + Data Entry area on the Lower Overlay Strip to select a round rate. This will automatically round finger positions to the nearest half step after you complete a glissando, or at any time during a note. If you are playing vibrato the average finger position will be rounded so that the vibrato will be centered at the nearest half step. A Round Rate of 0 means no rounding (default); 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. Note: This Round Rate mechanism is a separate feature from Round Initial, and it may be used with or without Round Initial.

You can use a MIDI foot pedal to change the round rate as you play; see details in the MIDI Input topic at www.HakenAudio.com.

Tuning

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

To select one of twelve Just tuning tonic centers, touch Tuning+ and then, with the RED button still held in, touch a note in the *octave below* middle C. If you touch C, the Just C tuning will be selected; the C#, Just C# tuning 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.

To select n-tone Equal tuning, touch Tuning+ and then, with the RED button still held in, touch a number in the Program + Data Entry area. The number can be any value from 1 to 50; it specifies the number of equal divisions per octave.

To select one of the eight downloadable custom tunings, touch Tuning+ and then, with the RED button still held in, touch a number between 80 and 87 in the Program + Data Entry area. For information on defining your own custom tunings, please see www.HakenAudio.com.

The tuning can be reversed, so that the lower notes are to the right and the higher notes to the left. To select this reverse tuning, touch Tuning+ and then, with the RED button still held in, touch the 0 in the Program + Data Entry area.

To switch back to the default Equal tuning, touch Tuning+ and release the RED button without touching elsewhere. You can use MIDI In to select tuning; for details see the MIDI Input topic at www.HakenAudio.com.

If you would like to control a Moog Voyager through MIDI, you need to configure for the Moog Voyager's non-linear pitch bend: Touch Tuning+ and then, with the RED button still held in, touch 101 in the Program + Data Entry area. Use Tuning+100 to get back to the linear pitch bend that is used for all other MIDI synths.

If you would like to communicate with Kyma through MIDI rather than FireWire, configure Tuning+103 or Tuning+104. The Continuum will send a special NRPN to Kyma so that Kyma maps MIDI channels to Kyma voices. Kyma will set the Continuum's polyphony according to the currently loaded Kyma Sound.

Tuning+103 uses normal 14-bit pitch bends, Tuning+104 uses controller 87 to get 21-bit pitch bend accuracy, and controller 88 to get 14-bit pressure accuracy. Use Tuning+100 to get back to regular Midi output.

To help you tune Analog synthesizers, the CVC will output an A440 reference voltage if you hold in the RED button, touch Tuning+ then 60+ in the Data Entry area, then release the RED button. Do it again to turn off the tuning output.

3.10 MIDI Velocity

Select one of two options for MIDI velocity: “z” encodes the initial finger pressure, “127” always encodes key velocity 127. The latter is default.

If you are using a Continuum Voltage Converter, configuring MIDI Velocity “z” will activate the CVC’s Velocity Gate feature. The Gate voltage outputs will be scaled according to the initial finger pressure. In this mode, the Gate is not intended for triggering envelopes; instead, it can be used to control analog parameters that depend only on the initial finger pressure. Configuring MIDI Velocity “127” is normal operation, with full-scale Gate voltages for every finger touching the surface, no matter what the initial finger pressure.

3.11 Bend Reset

Select one of two options for pitch bend reset: “on” resets pitch bend 100 ms after the finger is lifted, “off” does not. The latter is the default; the former is available for synthesizers or software (such as Logic) that impose a maximum rate for pitch bend or do not preserve the order of MIDI Pitch Bend and Key On messages. Such synthesizer limitations will cause problems: the note following a long glissando will have an audible pitch glissando when it starts. You can work around this problem by enabling Pitch Bend Reset.

In addition to resetting the pitch bend, the channel controllers for finger pressure and front-back position will also be reset 4000 ms after the finger is lifted. If finger pressure is configured to control channel volume (the default), this avoids leaving the MIDI channels at zero volume after a finger has been lifted.

3.12 Inputs

Merge+ 0-29

By default, the Continuum Fingerboard merges MIDI messages from on channels 1 through 15 of the MIDI In jack into all of the following: MIDI Out jack, CVC (Continuum Voltage Converter), and Kyma. The MIDI In messages are merged with the MIDI messages that track fingers on the playing surface. Avoid having both the playing surface and the MIDI In using the same MIDI channel; the merged MIDI messages will interfere with each other.

Fingers on the playing surface will generate output for MIDI channels depending on the Polyphony and Split settings. The order in which the new notes from the playing surface are assigned to MIDI channels can be LRU (assign the new note to the Least Recently Used voice) or LVN (assign to the Lowest Voice Number). The default is LRU.

If necessary, it is possible to configure the Continuum Fingerboard to output polyphonic MIDI information on one MIDI channel; this is called *single-channel mode*. The Continuum Fingerboard is inherently a multi-channel MIDI device, and in order to operate in single-channel mode for polyphonic Continuum Fingerboard playing, a few compromises have to be made. The pitch deviation is based on the finger with maximum deviation. The front-back (y) position is based on the average front-back position of all fingers. If you configured your Continuum Fingerboard to use channel pressure, single-channel mode will use polyphonic aftertouch; otherwise, single-channel mode will encode the average pressure of all fingers with the pressure (z) controller you configured. Single-channel mode is really only beneficial if the Continuum Fingerboard is connected to a MIDI device or sequencer that has trouble dealing with simultaneous information on multiple channels.

You may use the Continuum Fingerboard together with a MIDI keyboard, to get functionality like a super-precise pitch ribbon. This is called *external note mode* (Merge +31). The Continuum Fingerboard surface will be used to add pitch bends and controller values to MIDI notes generated from a MIDI keyboard's output. All notes will be generated by the MIDI keyboard, and only bending and controller values will be provided by the Continuum Fingerboard. You can externally merge the Continuum Fingerboard's MIDI output with your MIDI keyboard's output, or you can use the Continuum Fingerboard to do the merging by plugging your MIDI keyboard's output into the Continuum MIDI in. The MIDI keyboard must be configured to use MIDI channel 1. For external note mode to work properly, the Continuum Fingerboard must be set to polyphony 1. Configure the Pitch Bend range of the Continuum to your personal taste, keeping in mind the pitch bend range of the synth you are controlling. A Bend Range of 12 on the Continuum will mean that a one octave finger movement on the Continuum Fingerboard corresponds to a full-scale bend on the synth. A Bend Range of 24 on the Continuum will mean that a two octave finger movement on the Continuum Fingerboard corresponds to a full-scale bend (resulting in finer control than the 12 setting). You can even choose larger Bend Range values for even finer control. Additionally, when using this external note mode the Y and Z directions will still continue to output controller value messages. This can dramatically add to the overall expressive possibilities in performance. If you would like to slide into exact half-step transpositions, you can use external note mode together with Round Rate (see section 3.9). If you would like to use several fingers touching the playing surface to make step-like or sliding pitch bends, you can use external note mode together with Legato or Portamento (see section 3.6). If you would like to use nonlinear or position-warped bend functions, you can use external note mode together with any custom tuning table you define (see tuning discussion at www.HakenAudio.com). Possibilities here could include having certain areas of the Continuum Fingerboard surface set so that the pitch bend is a fine control (for accurate and subtle pitch vibrato effects) to other areas where pitch bend is coarse (for dramatic and wild pitch sweeps).

You can select how MIDI In gets merged, and how channels are assigned for finger activity on the playing surface. Hold in the RED button and touch Merge+, then without releasing the RED button, touch a number in the Program + Data Entry area:

Use LRU assignment for fingers on the playing surface, and:

- 0: Disable Merge
- 1: Merge to MIDI Out jack (playing surface activity is also sent to MIDI Out)
- 2: Exclusive merge to MIDI Out jack (playing surface activity is not sent to MIDI Out)
- 3: Merge to CVC (playing surface activity is also sent to CVC)
- 4: Exclusive merge to CVC (playing surface activity is not sent to CVC)
- 5: Merge to Kyma (playing surface activity is also sent to Kyma)
- 6: Exclusive merge to Kyma (playing surface activity is not sent to Kyma)

Use LVN assignment for fingers on the playing surface, and:

- 10: Disable Merge
- 11: Merge to MIDI Out jack (playing surface activity is also sent to MIDI Out)
- 12: Exclusive merge to MIDI Out jack (playing surface activity is not sent to MIDI Out)
- 13: Merge to CVC (playing surface activity is also sent to CVC)
- 14: Exclusive merge to CVC (playing surface activity is not sent to CVC)
- 15: Merge to Kyma (playing surface activity is also sent to Kyma)
- 16: Exclusive merge to Kyma (playing surface activity is not sent to Kyma)

Use single-channel mode for fingers on the playing surface, and:

- 20: Disable Merge
- 21: Merge to MIDI Out jack (playing surface activity is also sent to MIDI Out)
- 22: Exclusive merge to MIDI Out jack (playing surface activity is not sent to MIDI Out)
- 23: Merge to CVC (playing surface activity is also sent to CVC)
- 24: Exclusive merge to CVC (playing surface activity is not sent to CVC)
- 25: Merge to Kyma (playing surface activity is also sent to Kyma)
- 26: Exclusive merge to Kyma (playing surface activity is not sent to Kyma)

Use external note mode to generate bends and controller values to merge with MIDI keyboard output (see the external note mode description above for additional configuration requirements):

- 30: Disable Merge (use this if you externally MIDI-merge Continuum with MIDI keyboard)
- 31: Merge to MIDI Out jack (use this if you connect your MIDI keyboard to Continuum MIDI in)
- 33: Merge to CVC (external note mode for your analog synth through the CVC)
- 35: Merge to Kyma (external note mode for Kyma)

To select the default Merge configuration (which merges to all three: MIDI out, CVC, and Kyma), touch Merge+ and release the RED button without touching the Program + Data Entry area.

Merge+ 50-99

If you have a Continuum Voltage Converter (CVC), you can select the output voltage ranges. Hold in the RED button and touch Merge+, then without releasing the RED button, touch a number in the Program + Data Entry area. Numbers 50-59 are for linear Z encoding, numbers 60-69 are for squared Z encoding. (Linear Z encoding tends to be good for patches that have audio-taper amplitude controls, squared Z encoding tends to be good for patches that have linear-taper amplitude controls.)

- 50 or 60: Gate 0v to 10v; X 1v/octave with middle C at 0v; Y 0v to 10v; Z 0v to 10 v
- 51 or 61: Gate 0v to 10v; X 1v/octave with middle C at 0v; Y -5v to 5v; Z 0v to 5 v
- 52 or 62: Gate 0v to 5v; X 1v/octave with middle C at 4v; Y -5v to 5v; Z 0v to 5 v
- 53 or 63: Gate 0v to 10v; X 1v/octave with middle C at 0v;
Y constant 0v for near half of playing surface, 0v to 10v for far half; Z 0v to 10 v
- 54 or 64: Gate 0v to 10v; X 1v/octave with E3 at 0v; Y -5v to 5v; Z 0v to 10 v
- 55 or 65: Gate 0v to 10v; X 1.2v/octave with A440 at 5v; Y 0v to 10v; Z 0v to 10 v
- 56 or 66: Gate 0v to 5v; X 1v/octave with middle C at 2v; Y 0v to 5v; Z 0v to 5 v

New CVC voltage setup choices can be added via a firmware update to your Continuum. If you decide you need a voltage set up not listed above, let Haken Audio know your specifications, and Haken Audio will provide a firmware update including your new voltage set up.

Ext+

Some Continuum Fingerboards have two quarter inch input jacks (and no MIDI Thru connector). You may specify which MIDI controller corresponds to each jack. The quarter inch input jacks have been tested with Yamaha FC4, FC5, and FC7 pedals. Using a quarter inch jack is exactly equivalent to sending the corresponding MIDI controller value to the Continuum Fingerboard's MIDI In on channel 16; see the MIDI Input section at www.HakenAudio.com for details. To configure the jacks from the playing surface, touch Ext+ and then, without releasing the RED button, select a number in the Program + Data Entry area:

- 0: Ext 1 is Sustain Pedal, Ext 2 is Sostenuato pedal (can be continuous or switch pedals)
- 1: Ext 1 is Sustain Pedal, Ext 2 is Mono Switch (switch pedal enables/disables Mono Interval)
- 2: Ext 1 is Sustain Pedal, Ext 2 is Red Switch (switch pedal equivalent to RED button)

- 10: Ext 1 is Hold2 (second Sostenuato pedal), Ext 2 is Sostenuato pedal
- 11: Ext 1 is Hold2 (second Sostenuato pedal), Ext 2 is Mono Switch
- 12: Ext 1 is Hold2 (second Sostenuato pedal), Ext 2 is Red Switch

- 30: Ext 1 is Instant Round pedal, Ext 2 is Sostenuato pedal
- 31: Ext 1 is Instant Round pedal, Ext 2 is Mono Switch
- 32: Ext 1 is Instant Round pedal, Ext 2 is Red Switch

- 40: Ext 1 is Toggle Octave pedal, Ext 2 is Sostenuato pedal
- 41: Ext 1 is Toggle Octave pedal, Ext 2 is Mono Switch
- 42: Ext 1 is Toggle Octave pedal, Ext 2 is Red Switch

In addition to selecting one of the Ext+ options above, you may also configure the Toggle Octave pedal:

Ext+100: Toggle Octave shifts down one octave (default)
Ext+101: Toggle Octave shifts down two octaves
Ext+102: Toggle Octave shifts down four octaves

3.13 Octave Shift

You may select an octave shift for the pitch encoding. You can choose between 2 octaves down, 1 octave down, no shift, 1 octave up, or 2 octaves up.

3.14 Changes

To lock the current configuration and disallow configuration changes, touch Lock. To unlock the current configuration, touch Unlock.

3.15 Configuration Save

To store the current configuration for later recall, hold in the RED button and touch at one of the positions labeled Configuration Save 1 through 10. This will save the current program number, polyphony, bend range, front-back finger position MIDI controller, finger pressure encoding, Mono Function, Mono Interval, Split, rounding options, MIDI velocity encoding, bend reset, and octave shift.

3.16 Program + Data Entry

The Continuum Fingerboard will transmit MIDI Program Change on all active MIDI channels if you press the RED button and touch a program number in the Program + Data Entry area. Touch 1 through 9 and then release the RED button for program numbers 1 through 9. Touch 10+ then release the RED button for program 10. Touch 10+, and, while the RED button is still pressed, touch a number 1 through 9 for programs 11 through 19. Similarly you may select programs 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120 with a single touch, and the other program numbers with two touches.

To avoid having any Program Change transmitted by the Continuum Fingerboard, configure Program number 0.

The Program + Data Entry area is also used in conjunction with the Front-Back (z) Select+, Pressure (z) Select+, Round Rate+, Inputs Merge+, and Inputs Ext+; for details see those descriptions above.

3.17 Discarding MIDI Configurations

Discard all the MIDI Configurations by pressing and holding the RED button (and not the GREEN button) as you turn on the Continuum Fingerboard. After the LEDs light up and the RED LED turns off again, release the RED button, and you will have the default configuration for MIDI encoding.

4 Hardware Problems

If you suspect your Continuum Fingerboard is not functioning properly, please consider the following other possibilities:

Discard the MIDI Configuration and Reconfigure MIDI:

Discard the current configuration as outlined in Section 3.17. Use Section 3 to guide you in reconfiguring your MIDI encoding.

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. If you are using Kyma, restart Kyma, and try your Sound controlled by a standard MIDI keyboard and sliders to make sure your Sound is working properly.

Recalibrate:

Perform the calibration procedure described in Section 2.

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.

4.1 Sensor Stuck On, or Sensor Intermittently Turn On

The Continuum Fingerboard has hundreds of Hall-Effect sensors. If 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, hold in RED and GREEN buttons (*do not* touch the playing surface of the Continuum Fingerboard while you do this); the RED and GREEN lights will flicker, after a few seconds you can release the buttons. This will set the at-rest threshold for the sensors and should quiet any sensor that was active while you pressed the buttons.

4.2 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, hold in the GREEN button (and not the RED button) and, before you release the button, press a finger on the playing surface location corresponding to the pitch discontinuity. When the flawed sensor is detected, the GREEN light will flash quickly; then you can release the GREEN button. A sensor that is marked flawed will not be used in the finger tracking, and thus the pitch discontinuity should be resolved.

4.3 Clearing the Flawed Sensor List

To clear out the list of sensors marked as flawed, hold in the GREEN button (and not the RED button) as you power on the Continuum Fingerboard. After the LEDs light up and the GREEN LED goes off again, this indicates the list of flawed sensors has been cleared; you can now release the GREEN button.

5 Do-It-Yourself Repairs and Adjustments

The four hex screws in the top of the Continuum Fingerboard hold its top frame to the bottom frame. *Do not adjust these screws*; if the screws are loosened, 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.