

# ECE402 Sound Design Lab

Electronic Music Survey Course – Haken and Cheng

Homework #0: Study this handout; this page is the 1<sup>st</sup> of 4 pages covered by the in-class quiz during the 3<sup>rd</sup> lecture.

Lab #0: See “Your First Lab Session” below.

## Start Up Your Lab Bench:

- (1) If the computer is not on the login screen, get to the login screen, and log in.
- (2) Make sure the Continuum Fingerboard is on. It has a power light in upper left corner, and power switch far right end.
- (3) Run **Haken Editor** (C:\Haken Editor\Haken Editor.exe) and **wait 20 seconds** for it to appear on screen.  
If Windows asks security questions, you may have to click “more info”, “run anyway”, and “OK”.
- (4) Look at the Haken Editor, and verify the areas circled in the screen shots on the next page.

## Haken Editor:

The Haken Editor allows you to select and modify Continuum Fingerboard’s built-in sounds using the EaganMatrix. The EaganMatrix is a unique modular digital synth; you will learn it during labs throughout the semester.

## Working in the lab:

Take turns “driving” – let everyone in your lab team type and use the mouse and get familiar with the EaganMatrix. All lab assignments (tutorial materials) are on-line in the form of assigned videos. Stop the videos to try it out in the EaganMatrix. On-line documentation is available in the Haken Editor’s cogwheel menu; it is also in hardcopy in the lab.

Keep all your lab team’s files in a directory you create on the network V drive and **save changes only in your directory**.

Use descriptive names for EaganMatrix preset files you save in your directory on the V drive during lab sessions. *Keep track of any interesting results and things you might want to investigate further for your final project!*

## Devices at each Lab Bench:

- The **Continuum Fingerboard**, which has an internal audio DSP to produce audio as well as Midi
- The **Windows PC**, which runs the Haken Editor and stores your files. It also has some optional-to-use utilities like Adobe Audition (for spectrum analyzer and waveform display) as well as Audacity (for recording).
- The **Arturia BeatStep** which provides physical knobs for use with the Haken Editor.
- The **Mackie Mixer**, which has a separate **GAIN knob** for each of its analog audio inputs:
  - (1) Stereo audio from the Continuum’s internal DSP
  - (2) Stereo audio from the PC
  - (3) Audio from the microphone
  - (4) Audio from a device you bring in, if you likeThe Mackie routes each audio input to one of two destinations, based on the input’s **MUTE button**:
  - (1) Stereo audio to speakers, called **Main Out (MUTE button not pressed)**
  - (2) Stereo audio to Continuum’s digital audio input, called **Alt3-4 (MUTE button pressed)**
- A **Gefen HRX3** A/D connects Mackie Mixer Alt3-4 to the Continuum Fingerboard’s digital audio input, available inside the EaganMatrix on the **AesIn matrix rows**.
- A **Roland UM-ONE** USB-Midi cable connected between the Continuum Fingerboard and the PC.
- A **Yamaha Damper Pedal** (continuous-valued return-to-zero) and a **Yamaha Expression Pedal**,

*Never modify the lab bench cabling!* Use the Mackie Mixer for routing. Please keep the standard setup intact for all lab teams.

## Connecting your own Audio Input:

If you would like to use the Continuum Fingerboard and the EaganMatrix to process audio from your electric guitar, your acoustic pickup, or a device you built, you may connect it through an unused input on the Mackie mixer. Do not change the cabling on the ECE402 lab bench to connect your device; leave existing cabling as it is; have your audio signal go through an unused input on the Mackie mixer.

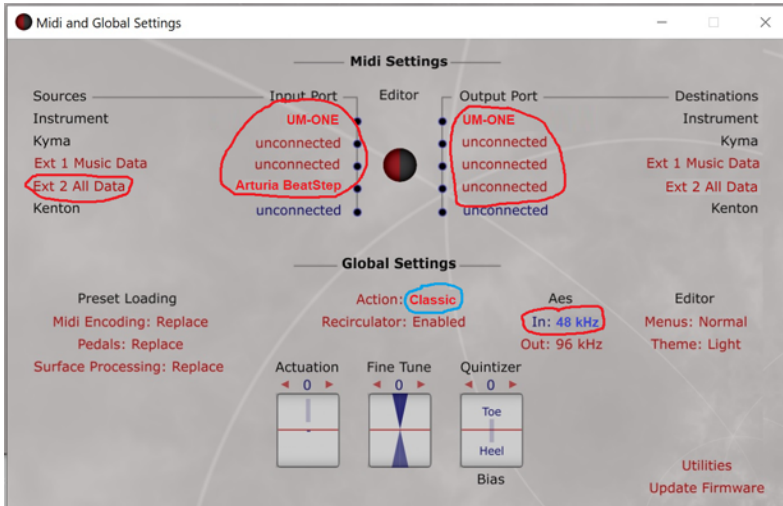
If you connect your equipment to a microphone input on the Mackie, please be sure Phantom Power (switch on back right of Mackie) is off. Phantom power outputs DC power on the microphone inputs and can destroy your device. Study the Mackie mixer circuit diagram (on a following page) for details.

# ECE402 Sound Design Lab (continued)

Homework #0: Study this handout; this is the 2<sup>nd</sup> of 4 pages covered by an in-class quiz given during the 3<sup>rd</sup> lecture.

Below are two screen shots from the Haken Editor; it should look like this after you complete the “Start Up Your Lab Bench” procedure on the previous page.

## “Midi and Global Settings” (in the Haken Editor’s cogwheel menu):

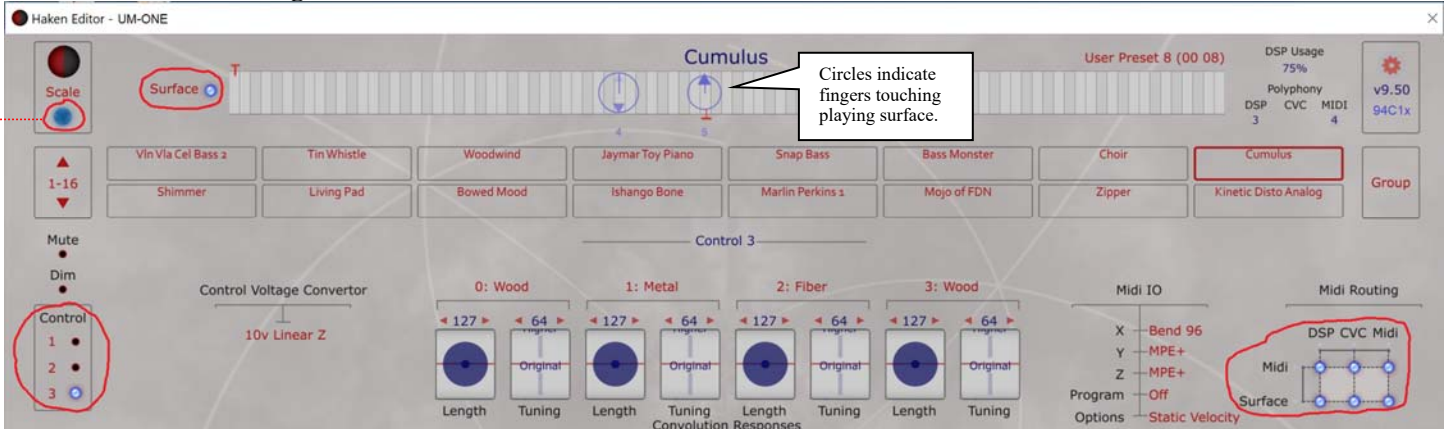


Verify settings in red circled areas. Items written in red typeface (and lights with a red halo) are changeable; if they are incorrect, click them to change. Blue items are not clickable; blue items report current state. The blue **48 kHz** indicates digital audio received from the Gefen A/D converter (Mackie Mixer Alt3-4 output).

Sometimes Windows prepends numbers to “UM-ONE” – you can ignore those numbers.

About the blue circle at left: You will not be able to select “Light Action” in the lab; only newer Continuums are able to respond to such low finger pressures. If you are interested in the Light Action, please talk to Lippold@HakenAudio.com.

## Main Haken Editor Page:



## Most Common Problems (first correct any errors in “Midi and Global Settings,” as shown above):

**No Sound:** Load a system preset from the Haken Editor. Check GAIN knobs on Mackie Mixer.

- Editor Not Talking to Continuum (no big blue light in Editor):** Find USB-Midi cable from PC to Continuum, unplug it at the PC end, and after 5 seconds replug it to clear USB driver.

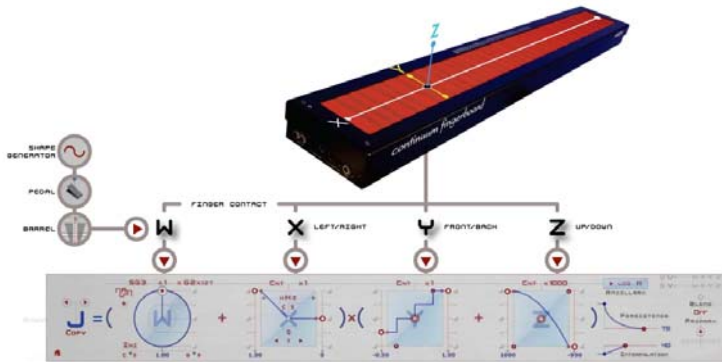
**Lab #0:** During your lab time in the first week of the semester, do these three things: **(1)** After logging in at your lab workstation, create your lab team’s directory in V:\ECE402\Lab\. Name the directory “ECE402\_XXX\_yyy” where XXX and yyy are the netids of the people in your team. During future labs, you will save at least one EaganMatrix preset you modify (or presets you create from scratch) in this directory, after you watch the assigned tutorial videos. **(2)** Start up the Editor, verify images look as shown above. Click red words “**System Presets**” (to left above preset list) to display the EaganMatrix; click there again to get back to System Presets list. **(3)** Watch Loopop’s introduction to EaganMatrix: “Haken Continuum in depth review, and what is the Matrix...?” [https://www.youtube.com/watch?v=HkYVJ\\_agLko](https://www.youtube.com/watch?v=HkYVJ_agLko)  
*ECE402 has no pre-labs or lab write-ups to hand in. During all labs you will watch assigned tutorial videos, and then you are required to experiment with what you learned to fill out the two hours. In each future lab, you must save at least one preset you worked on into your lab team’s directory. Do not leave early for Lab #0; fill the remainder of your two hours trying various EaganMatrix system presets.*

**Lab Schedule:** During the first ECE402 lecture, you will choose lab partners, lab times, and a lab bench. The lab team schedule will be on the ECE402 web site; if you like you may use the lab when nobody else is signed up.

# ECE402 Sound Design Lab (continued) - EaganMatrix

Homework #0: Study this handout; this is the 3<sup>rd</sup> of 4 pages covered by an in-class quiz given during the 3<sup>rd</sup> lecture.

The EaganMatrix is the modular digital synthesizer built into the Continuum Fingerboard. It allows you to create sound algorithms by connecting audio and control modules via a two-dimensional patching matrix. The EaganMatrix is based on this fundamental observation: HOW you control a sound algorithm is at least as important as the QUALITY of the sound algorithm. In the Continuum, several kBytes of sensor data per millisecond capture the player's finger movements. In the EaganMatrix, this data is continuously analyzed, optimized, and transferred at a sub-millisecond rate to control low-level synthesis parameters. The design of the EaganMatrix is capable of an "organic" control/feedback loop between the player and the sound that is reminiscent of a player's interaction with an acoustic instrument.



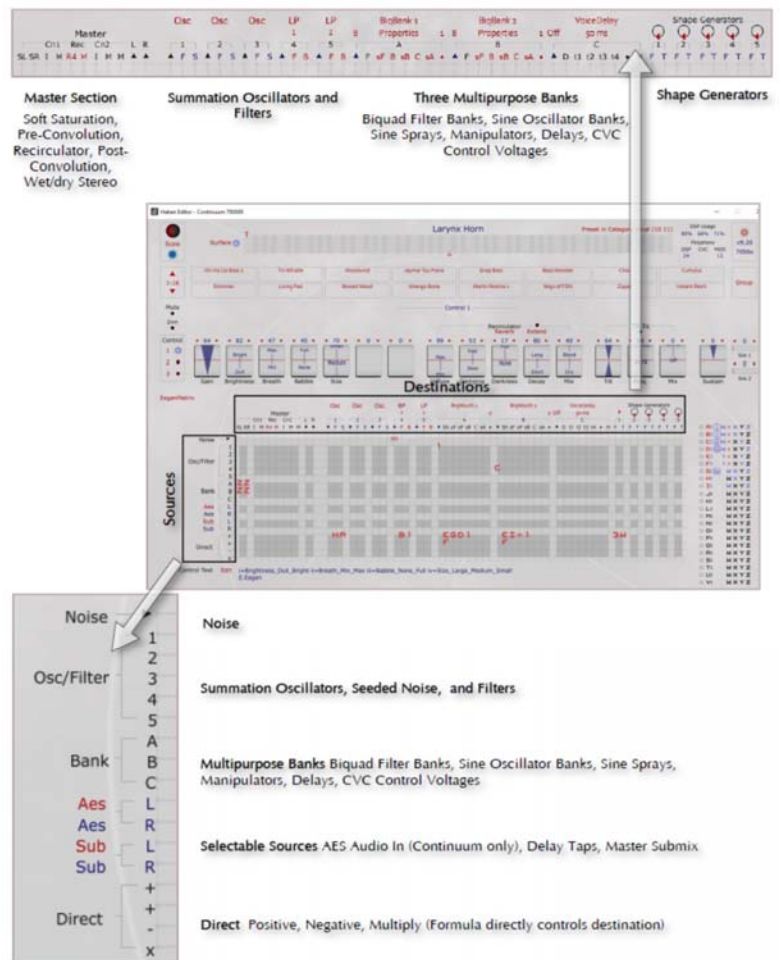
Canadian sound designer and Continuum performer Edmund Eagan invented the the EaganMatrix. Prof Haken did the DSP programming that underlies the EaganMatrix. Edmund Eagan was inspired by the classical modular matrix patching synthesizer EMS VCS3. However, unlike the analog predecessors, the EaganMatrix doesn't use pins to make patch point connections. Instead, the user defines dynamic formulas and places them at matrix patch points. These formulas are a function of the position and pressure of each finger on the playing surface, Shape Generators, and other formulas.

The graphical interface for the definition of formula J is shown at left. The formula uses the X (pitch), Y (front-to-back), and Z (pressure) position of a finger on the Continuum's playing surface to compute a control value. When the formula is assigned to a patch point in the matrix, the formula controls the flow of sound from the source module on the matrix row to the destination module on the matrix column.

In the ECE402 lab you will learn to define new formulas, and how to place them in the matrix to make sounds.

*For the quiz in lecture 3*, know sources are labeled to left of matrix, and destinations above matrix (see marked black rectangles in this image).

*Also know*: Editor items written in red typeface (and lights with a red halo) are changeable; click them to change. Click Control 1, 2, or 3 to see different controls. Click red words "**System Presets**" (to left above preset list when the preset list is displayed) to get matrix to appear as shown in this image. Click a formula inside matrix, or in thumbnails to right of matrix, to see a formula. Click red word "**EaganMatrix**" (to left above matrix) to get preset list.

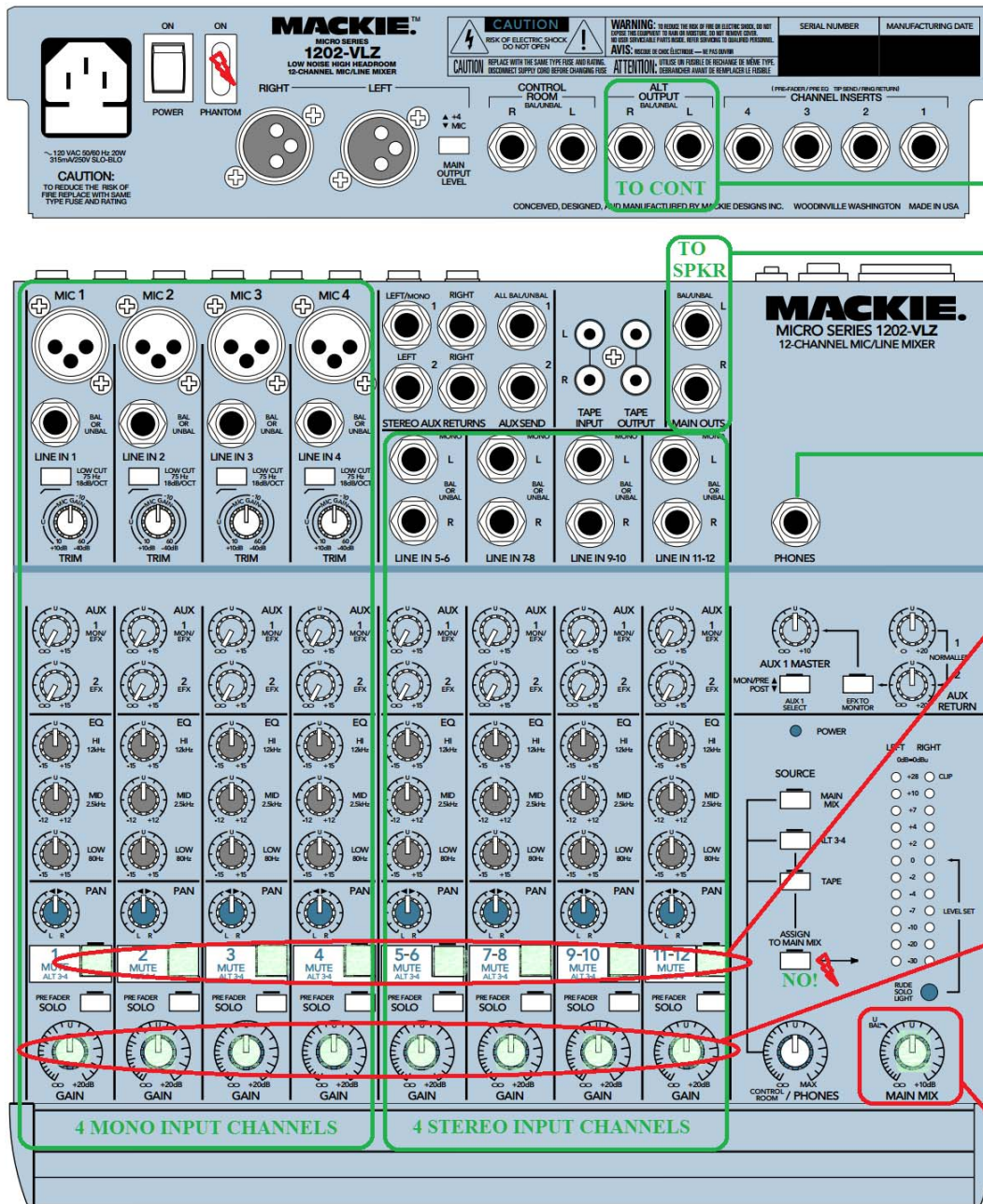




# ECE402 Sound Design Lab (continued)

Homework #0: Study this handout; this is the 4<sup>th</sup> (and last) page covered by an in-class quiz given during the 3<sup>rd</sup> lecture.

This is an image of the Mackie Mixer used in the lab. *For the quiz you must know* the locations and functions of the MUTE, GAIN, MAIN MIX in this image; those are the *only* controls you change during the lab.



Mixer analog output for mixer channels that have MUTE button pressed. This goes to Gefen A/D, then to Continuum's AES3 digital audio in.

Mixer analog output for all mixer channels with MUTE button up. This goes to the speakers, which each have a built-in amplifier.

Mixer analog output to PC (Adobe Audition)

Mute button up lets you hear the mixer channel through the speakers. Mute button pressed does **not** mute the channel; instead, it sends the mixer channel to Continuum's AES3 digital audio in (via Gefen A/D).

To mute a mixer channel, turn its gain knob full left. To hear the channel, turn up its gain knob.

Overall level for speaker output.

⚡ Leave Phantom Power off (described on one of the previous pages of this handout).  
Do not press "Assign to Main Mix" (it causes an internal feedback loop – check out the circuit diagram on next page).

All knobs above are shown in default position.  
Please leave all knobs other than GAIN and MAIN MIX in default position

Quickly turn down the MAIN MIX if you accidentally get too-loud sounds. Do not use headphones – errors while editing the EaganMatrix can result in very loud sounds, and headphones or earbuds risk hearing damage.

Homework #0: Look at this page, but this page will not be covered by the in-class quiz given during the 3<sup>rd</sup> lecture.

**PHANTOM POWER No!**

**Microphone ... and 3 unused mono inputs**

**From Continuum Fingerboard From PC**

**... and 2 unused stereo inputs**

**To digital audio input of Continuum Fingerboard via A/D**

**To PC**

**To Left Speaker**

**Turn down GAIN knob on inputs you do not want to hear. Press MUTE (labeled Main/Alt in this diagram) on inputs you want routed to digital audio input of Continuum Fingerboard. Release MUTE on inputs you want routed to speakers.**

**Do not randomly press buttons on the mixer. You will make a mess of things. Study this diagram to figure out what the mixer is doing.**

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BLOCK DIAGRAM  
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MACKIE MS1202-YLZ PRO  
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