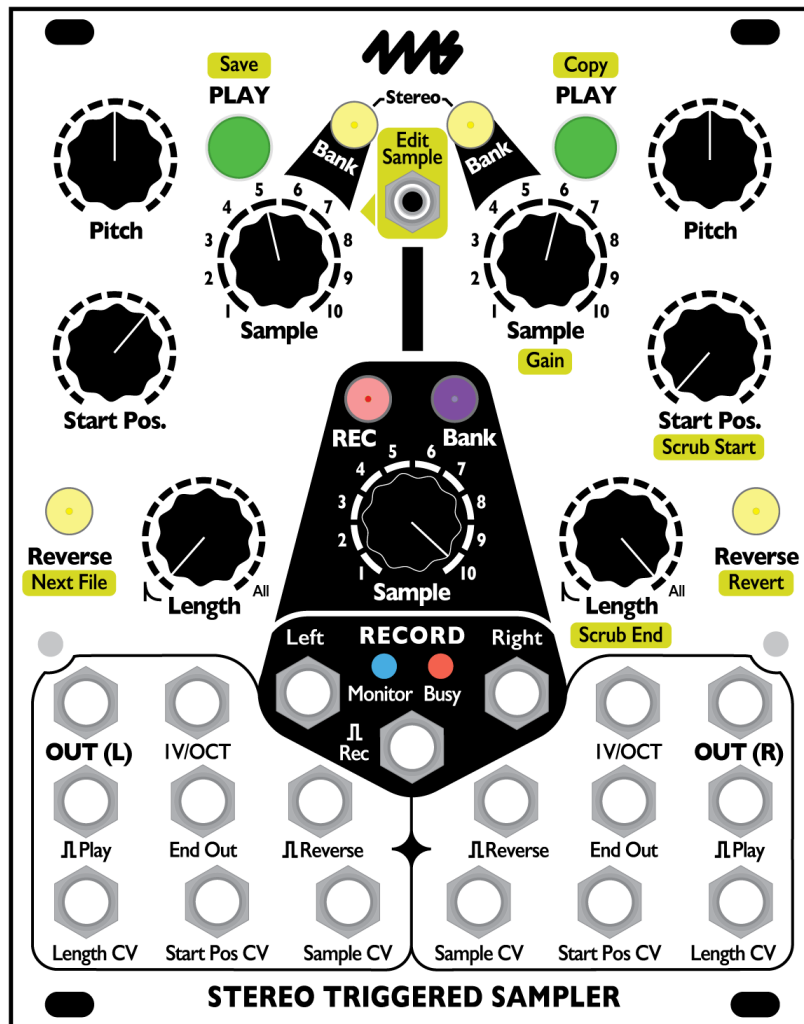# Stereo Triggered Sampler

4ms Company

User Manual 1.1 – March 7, 2022
for firmware v1.5

The Stereo Triggered Sampler is a high fidelity, two-channel stereo audio recorder and playback module. The STS can record high quality stereo WAV files while simultaneously playing two different stereo files. A maximum of 600 samples can be loaded at one time from the removable/swappable microSD card, in a variety of formats up to 96kHz/32-bit/stereo WAV. All sample parameters (1V/oct pitch, sample file selection, length, and start position) are CV controllable, and trigger jacks for play, record, and reverse allow for synchronization. On-board editing tools allow you to set loop/trim points and gain, as well as assigning samples to banks and slots.

- Two independent stereo playback channels can play any of 600 samples simultaneously
- Recording channel creates stereo WAV files directly onto microSD Card for immediate use
- Extremely low noise, high fidelity design
- Plays a variety of WAV files up to 32-bit/96kHz
- Intelligent file system makes loading large sample libraries easy by organizing banks into folders
- CV and controls for 1V/oct tracking, Start Position, Length, Sample selection, Reverse and Play
- Trim samples and set Loop points, adjust gain, and re-organize banks and sample slots on the fly.
- Includes microSD card with Sample Pack, SD adaptor, 10-to-16 pin power cable and M3 screws

Table of Contents

Setting up your Stereo Triggered Sampler

1. Remove the Stereo Triggered Sampler (STS) from the box and anti-static bag. The RAM chip on the STS may be damaged by static electricity; take care not to touch the circuit board.
2. Connect the free end of the power cable to a 16-pin Eurorack power header on your power supply distribution system, with the red stripe towards the -12V. The other end of the power cable is a 10-pin connector which should already be connected to the STS so the red stripe on the power cable is orientated towards the bottom of the module (the bottom is marked by a white stripe and the word "POWER"). Note: The STS is reverse-polarity protected, but other modules being incorrectly connected could damage anything on the power bus.
3. **Backup your microSD card before you first power the STS on!** We recommend you perform a full backup of the microSD card by using a computer (use the included SD card adaptor if needed). This will be useful if the card ever becomes damaged or you wish to restore the STS to the original factory settings and samples.
4. Securely screw the STS to the rails of your case. Power the system on.
5. Begin with **Tutorial 1: Basic Playback** on page 6 of this manual.
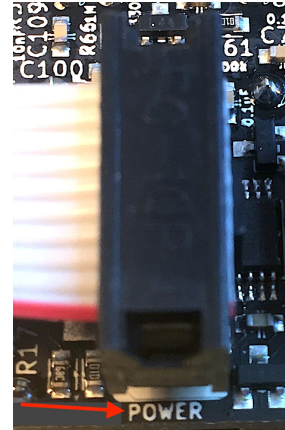
Never remove the microSD card when the *Busy* light is on!

Overview

- Up to 600 samples loaded at one time (10 samples per bank)
- Includes a microSD card with over 200 samples
- Extremely quiet, low noise and low jitter design
- Stereo or Mono operation:
  - **Stereo mode**: Two stereo files are mixed and played through the L and R output jacks (L+L and R+R)
  - **Mono mode**: Each file is mixed to mono and output through the channel's output jack (L+R and L+R)
- Firmware can be updated by playing an audio file into the STS

Two independent playback channels:
- Each channel outputs in mono or stereo through the shared L/R jacks
- **Play** button/trigger jack: Tapping the button or receiving a trigger starts/re-starts the sample
  - When **Length** is set to "All", the Play button starts/stops the sample (set in System Mode, see p.23)
- **Sample** CV/knob: selects a sample from the channel's bank
- **1V/OCT** CV and **Pitch** knob: playback pitch (-10 to +4.3 octave range)
  - Tracking: +/- 0.4cents over four octave range (C0–C3)
- **Start Pos** CV/knob: position in the sample to begin playback (loop start point)
- **Length** CV/knob: playback time (loop end point)
  - **Length** *knob at max*: entire file is played
  - **Length** *knob 50%-99%:* 200ms - 5s of the sample is played (beginning at the Start Position)
  - **Length** *knob <50%*: Percussive decay envelope is applied to the playback (attack-only envelope if playing Reverse)
  - **Length** *<1%*: Tiny grains are played (can be used to sweep through sample file data manually)
- **Reverse** button/jack: toggles forward/backwards
- **Bank** button: selects channel's bank

Tip: Hold **Bank** and turn the **Sample** knobs for fast selection of bank

- **Edit** button allows basic on-board editing features:
  - Set loop/trim points with **Scrub Start** and **Scrub End**
  - Set **Gain** (boost/cut from 10% to 500%)
  - Re-organize samples with **Next File**
    - Move samples around within a bank
    - Assign files from any folder on the microSD card into any sample slot (sub-folders are ignored)
  - **Copy** sample to multiple slots, each with their own loop/trim/gain settings
- **Reverse**+**Start Pos** button/knob combo allows for setting volume of each channel independently.
- Maximum file size for playback: 4GB per file (6.7 hours per file at 44.1kHz/16b/stereo)
- microSD Card is hot-swappable when **Busy** light is off: no power-down required to change cards
  - Samples that are pre-loaded into memory can continue playing while card is removed

Recording channel:
- Stereo recording can be simultaneous to operation of playback channels
  - Easily record output of sample playback, "bouncing" a play session into a new sample file
- Recording initiated by button or trigger
- Monitor mode lets you check the signal before starting a recording
- Record into any sample slot in any bank
  - Every recording is saved as a WAV file on the microSD Card and can be played back instantly
  - Edit features allow you to manually browse all the takes, and assign them to banks/sample slots
- Recording can be disarmed to prevent accidental recordings
- 44.1kHz/24-bit stereo or 16-bit stereo recording, selectable in System Mode
- "Unlimited" recording time (records continuously until card is full)
  - 256GB card = 18 days of continuous recording (432.9 hours)
  - Long recordings are split into 4GB WAV files

File Organization:
- Includes a high-speed 16GB microSD card, loaded with over 200 samples from

Richard Devine	Bogdan Raczynski	Animal Collective	Wobbly
Cristian Vogel	Moor Mother	Baseck	Robert Aiki Aubrey Lowe
Jay E	Anna Sitko	Daedelus	Nero Bellum
Marcus Fischer	Chris Carter	Paul Barker	Russell E.L Butler
Ignatius	Pailo	Thomas Fang	Hugo Paris/Marc Kate

- Record new samples directly to banks with the **RECORD** input jacks
- Load WAV files using a computer and the intuitive bank/color organization system
  - Drag folders of WAV files onto the microSD card, and each folder will become a bank
    - No need to rename WAV files
  - Folders starting with a color name will be loaded into that color bank
    - Example "Blue - Frooty Loops" will load into the Blue bank
  - Sub-folders are ignored, only folders in the root directory are scanned for WAV files
- Works best with "UHS Speed Class 3" cards with this symbol printed on the card: **3**

Electrical and Mechanical Specifications

- 20HP Eurorack format module
- 0.98" (25mm) maximum depth
- 10-pin Eurorack power header
- Power consumption (maximums): +12V@145mA; -12V@39mA; +5V rail not used
- Audio **OUT** jacks
  - Out:File = -1.8dB max deviation at 0Hz (DC) - 22kHz
  - 21V peak-to-peak = full scale
- Audio **Record** jacks
  - Out:In = max -1.0dB 3Hz-6kHz, -3dB 6k-11k, -7.6dB 11k-20k
  - 21V peak-to-peak maximum before clipping
- **End Out** jack
  - +10V trigger pulse
  - 13ms pulse width, typical (sample loop time > 17ms)
  - 2.75ms pulse width, minimum (at fastest sample loop time = 8ms)
- **1V/OCT** CV jack
  - -5V to +5V range, for -5 to +5 octave shift
  - *Note: 1V/oct jack combines with Pitch knob and sample file's sample rate, and the resulting pitch shift is limited to -9 octaves down and +4.3 octaves up*
- CV jacks (**Start Pos CV**, **Sample CV**, **Length CV**)
  - 0 to +5V range
  - Add to the position of the corresponding knob
- **Reverse**, **Play** ⊓, **Rec** ⊓ jacks
  - Incoming trigger toggles state or starts/restarts feature
  - Trigger voltage must be > 1.6V, rising edge is detected
- microSD card slot accessible from front panel
- **Edit** button accesses editing/organizational alternative features of some controls (printed in gold lettering)

Tutorial 1: Basic Playback

PLAY

The Stereo Triggered Sampler has two playback channels. Each channel has a **PLAY** button. Tap the **PLAY** button to play the currently selected sample in the currently selected bank for that channel. Tap it multiple times to re-trigger the sample.

Try it now! Set the left channel controls as shown:
- **Pitch** knob to center
- **Start Pos** to 0%
- **Length** to 100%
- Patch the **OUT(L)** and **OUT(R)** jacks to the left and right channels of your output mixer. *If you only have a mono speaker, just use **OUT(L)***

To speaker (left)

To speaker (right)
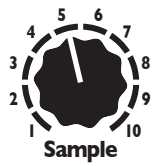
Sample

The **Sample** knob selects which sample in the current bank to play. There are 10 slots for samples per bank. Try turning the knob now. Notice that when you turn it to a new slot number (1–10), the **PLAY** button flickers. This indicates you selected a new sample. Hit the **PLAY** button again to play the new sample.
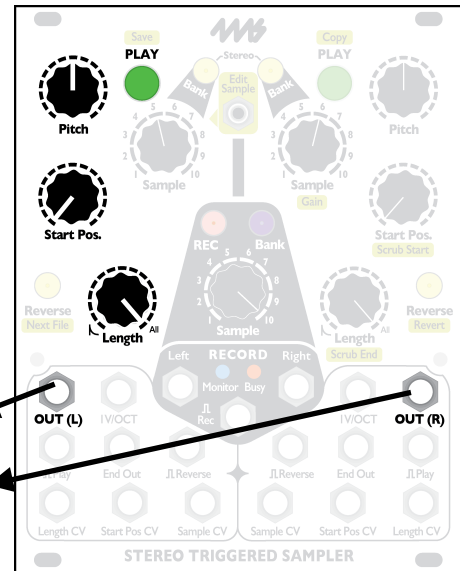
Bank

The **Bank** button changes banks. Tap the button to go to the next bank and notice that the **Bank** button's color changes. Each bank contains 10 samples. Go ahead and listen to all the samples in this bank using the **Sample** knob to select a sample and the **PLAY** button to play it. Take a moment to explore a few banks, tapping the **Bank** button to go to the next bank (you can go back a bank by holding **Reverse** while tapping **Bank**). For the next step, we're going to want a sample that will loop nicely, so pick a sample that's at least a couple seconds long.

Looping

Hold 0.5 sec.

PLAY

The STS is also great for looping samples. Go to a sample that's at least a couple seconds. Press and hold the **PLAY** button for half a second and the button will turn blue to indicate it's looping (*blue = loop*). You can let go of the **PLAY** button and it'll keep repeating

Pro tip: When looping, if you move the **Sample** knob it'll immediately start playing the new sample (as opposed to when not looping, you have to hit **PLAY** to hear the new sample)

the sample over and over. At any time if you want to stop looping, hold **PLAY** down again for about a second and it'll turn green or yellow-green to indicate the channel is not looping.

Pitch

Now let's play with **Pitch**. Turn this knob up to make the sample play back faster and at a higher pitch. Turn it down to play back slower and lower in pitch. The **Pitch** knob has a range of 8 octaves (4 octaves up, 4 octaves down). Note that the **1V/OCT** jack lets you go a bit farther (-9 to +4.3 octaves)

Length All

Next, let's try shortening the loop: turn the **Length** knob down a bit. As you turn **Length** down from 100% to 50%, the length/tempo will go from the full sample file length to under a second. From 50% to 0%, the length/tempo gets very short (~250ms down to ~8ms), and a decay envelope is applied to make it percussive.

Start Pos.

By now you should see how changing the **Length** changes the end point of the loop. The starting point of the loop is set by the **Start Pos.** Try turning this knob to see how this changes your loop. The knob works by percentage of sample file time: so setting **Start Pos** to 50% will make the sample start playing from the half-way point. Setting **Start Pos** to 100% doesn't give you much sample left to play, so you'll hear a short blip.
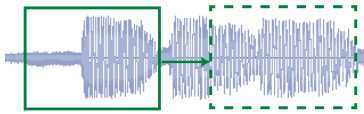
Start Pos *shifts entire sample window (start and end points)*
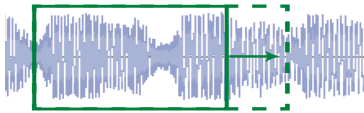
Length *changes end point*
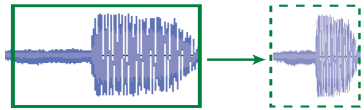
Pitch *stretches window when Length > 50%*

Notice that changing **Start Pos** does not change your tempo; it shifts the starting and ending points of the loop together, keeping a constant time. On the other hand, **Length** changes the total time by changing the end position and keeping the starting point constant.

 Let's do an experiment and see how **Pitch** and **Length** are related to the tempo of a loop. Set **Length** to 75% and turn **Pitch** to a few different settings while you loop a sample. Do you see how the tempo of the loop changes as you change **Pitch**? It should get shorter as **Pitch** gets higher. Now set **Length** to about 40% and play with **Pitch**. Do you see how the tempo of the loop does **not** change? That's because with **Length** under 50% the playback time is constant (regardless of Pitch). With **Length** over 50%, the audio sample data that's played is constant, even though it's stretched or shrunk. So if you set **Start Pos** and **Length** to capture a particular part of a sample (let's say it's a human voice saying the word "hello"), then as long as **Length** is over 50%, it will always play the word "hello" even as you adjust the **Pitch**.

Reverse

The STS can also play samples backwards. Simply tap the **Reverse** button to toggle reverse or forward playback. The button will be blue when it's in reverse mode, and off when it's in forward mode. In reverse mode, it plays from the ending position towards the starting position.

Pro tip: The tempo of a loop can be harnessed by using the **End Out** jack. This jack will fire a trigger whenever the sample loops, restarts, or stops playing. Try patching the **End Out** of the left side to the **Play Trig** jack of the right side, and looping the left or both sides. Now try patching **End Out** to a clock divider (such as the **RCD** or **QCD**) for a sample-based master clock!

Try this: hit **Reverse** while a long sample is playing forwards. The sound will reverse immediately and start playing backwards towards the start position. You can even keep hitting **Reverse** rapidly to keep a sample "up in the air".

When playing in reverse while **Length** is less than 50%, an attack-only envelope will be applied to the playback (as opposed to the decay-only envelope applied to forward playback with **Length** under 50%)

Tutorial 2: Navigating Banks

In the first tutorial you learned that tapping the **Bank** button moves you to the next bank. What if you went too far and want to go back a bank?

Go to Prev. Bank
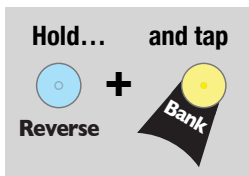
To move backwards by one bank, hold down that channel's **Reverse** button while you tap the **Bank** button. Try it now. Note that for the **Bank** button on the right side, you have to hold the **Reverse** button on the right side (and the same for the left **Bank** and left **Reverse**). Watch how when you go past the first bank (solid white), it wraps around to the last bank (green with two blinks in the default STS sample pack). What do these flashes mean? Let's find out!

Bank Organization
The banks on the STS are arranged by colors. The colors are arranged similar to a rainbow:

White   Red   Orange   Yellow
GreenCyan   Blue   Magenta
Lavender   Pearl

As you tap the **Bank** button, you move through banks in order from White to Pearl. When you reach Pearl, it loops back around to White, but this White is different—it blinks off every second or so. If you keep going, you'll see another White bank that blinks off twice every second. If you're using a new STS with the default sample pack, the banks are only full up until Green with two flashes (we call this "Green 2 blinks" or "Green-2" for short). After that, it wraps back around to solid White.

As you add samples to your card, you can fill up a maximum of 60 banks. Since there are 10 colors, that means each color can have 0 (solid) to 5 flashes. At 5 flashes, the bank button is flashing almost constantly. Empty banks will be skipped as you cycle through banks with the **Bank** button.

Starting bank · Solid · constant blinking · 4 blinks · 1 blink · 3 blinks · 2 blinks
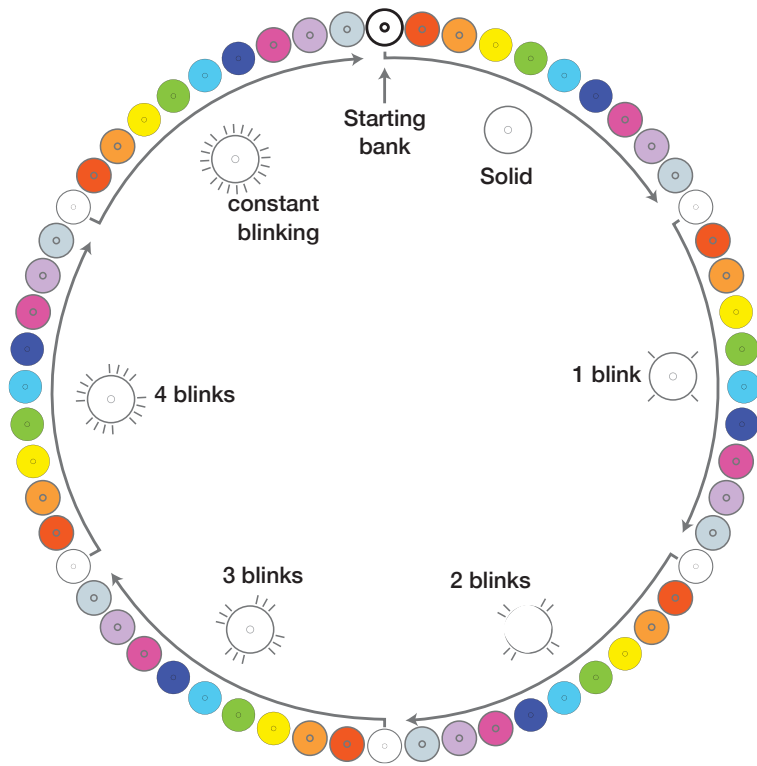
What if you've filled up your banks with samples and you want to go from the solid Red bank to Blue-3 (blue with 3 blinks)? Well, you could tap the **Bank** button a few dozen times, but there's a faster way.

Hold… and turn… …and/or turn

Sample (Left side) / Sample (Right side)
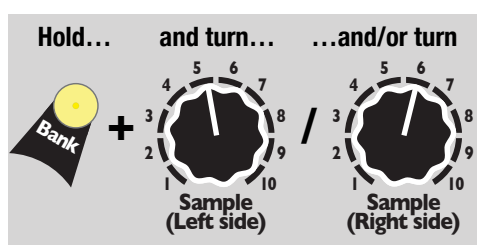
Quick Bank Select

To quickly change to a particular bank, just hold down the **Bank** button while you turn the **Sample** knobs. The left **Sample** knob selects the bank color, and the right **Sample** knob selects the bank blinks. The bank button will change colors and blinks as you turn the knob, but the bank won't actually change until you release the **Bank** button.

For example, to go directly to Yellow-2 on the left side of the STS, hold down the left **Bank** button and turn the left **Sample** knob until the light is yellow. Then turn the right **Sample** knob until the left **Bank** button is blinking 2 times. Release the left **Bank** button and it'll jump to Yellow-2. If Yellow-2 doesn't exist, then you'll end up in the last valid bank that the knobs pointed to.

If you want the right side's bank to change to a specific bank, do the same procedure but hold down the right side **Bank** button.

A quick way to go back to the first bank is to hold the **Bank** button and spin both **Sample** knobs to 0%.

Gotcha! While holding down a **Bank** button, the left **Sample** knob always selects the bank color, and right **Sample** knob always selects the bank blink number— this can be a bit confusing at first when you switch between changing the left and right side's banks.

Empty Banks

Tapping **Bank** moves you to the next bank that has samples in it, skipping empty banks. If you hold **Edit** while tapping **Bank**, you can browse all banks including the empty banks. Another way to go to an empty bank is with the **Bank Rec+Bank** trick (see Tutorial 3). Since the STS boots up with the **Bank Rec** button set to the first empty bank, this is a fast way to immediately jump to an empty bank. See the Copying, Creating Slices, and Assigning Samples sections for examples of why you might want to go to an empty bank.
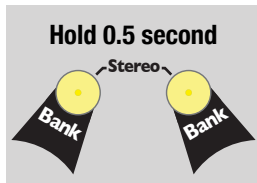
Stereo/Mono Mode

The STS can operate in stereo or mono mode.

Mono mode: Each sample that you play is mixed to mono and outputs through its own jack. So if you hit the left **PLAY** button, sound will come out of the **OUT(L)** jack only. Likewise for the right **PLAY** button, it only comes out the **OUT(R)** jack.

Stereo mode: Both the left and right **PLAY** channels play out of both **OUT** jacks. So if you hit the left **PLAY** button, you'll hear the left channel of your file on the **OUT(L)** jack, and the right channel on the **OUT(R)** jack. *If the file is mono, you'll still hear the sample play on both jacks.*

Toggle Stereo/Mono mode
To switch stereo/mono modes, hold down both **Bank** buttons for about half a second. *If you look carefully at the module, you'll see the word "Stereo" printed there to remind you.*

When you switch to stereo, the **PLAY** buttons pulse yellow in sync (sync=stereo). They will stay yellow every time you play a sample to show you're in stereo mode.

When you switch to mono mode, the **PLAY** buttons will independently flash green (independent=dual mono). They'll stay green while playing to show you're in mono mode.

The stereo/mono mode is saved to the microSD card as soon as you switch, so the next time you power on, it'll be in the same mode.

Channel Playback Volume
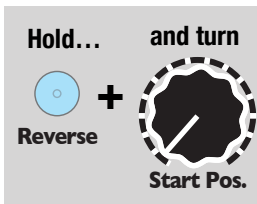
Adjust Channel Playback Volume
There's a hidden feature in the STS that lets you control the volume of each playback channel. This is especially important in stereo mode because the two channels get mixed together before reaching the output jacks.

To set the channel volume, hold down **Reverse** while you turn the **Start Pos** knob directly above it. The volume will not change until you turn **Start Pos** to the current volume setting. When you power-on the STS, the volumes are automatically set to 100%, so that means you have to turn **Start Pos** all the way up to 100% before the volume feature engages. After that, you can turn the knob down to reduce the volume.

Try it now: get a sample looping on both channels. Hold the left **Reverse** and turn the left **Start Pos** all the way up, then slowly bring it down. Hear how the volume of the left channel decreases? Now adjust the volume for the right channel using the right **Reverse** and **Start Pos**… you can even do both sides at once!

The **Reverse** button will not toggle reverse/forward mode when you use this feature. Also, the **Start Pos** won't be adjusted until/unless you move the **Start Pos** knob without the **Reverse** button being down.
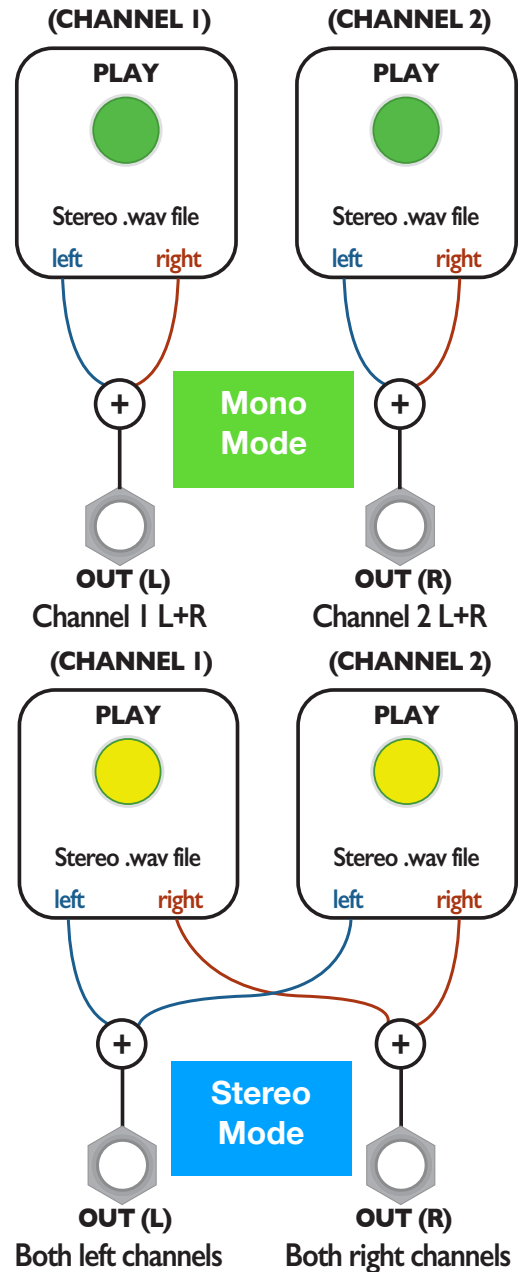
Tutorial 3: Recording Samples

Arm Recording:
Hold 0.5 sec
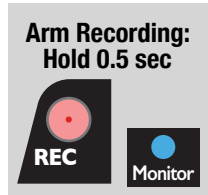
Enabling Recording
To use the **RECORD** section, you first have to enable (or "arm") recording by holding down the **REC** button for 2 seconds. This is to prevent accidental recording. When recording is armed, the **REC** button will flash.

Notice the blue **Monitor** light turns on. This means whatever signal is present on the **RECORD** inputs will be routed to **OUT(L)** and **OUT(R)**.

If you have a mono signal, patch it into the **Left RECORD** jack. If you have a stereo signal, patch into the **Left** and **Right RECORD** jacks. The STS always records in stereo—the Left signal will be copied to the Right if nothing is plugged into the Right jack. You should be hearing your input sound coming out the **OUT** jacks, but it's not recording yet— just monitoring.

Start/Stop Recording:
Tap button
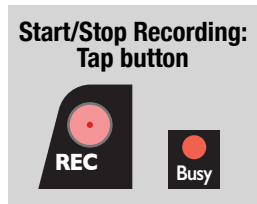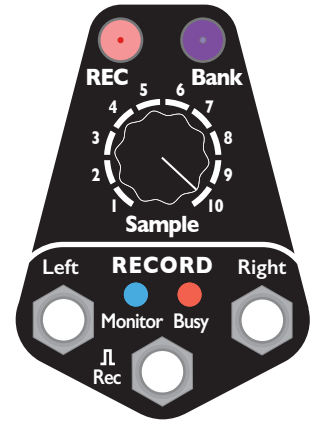
Start/Stop Recording
Tap the **REC** button to begin recording (or fire a trigger into the **Rec ⎍** jack). See how the **Busy** light turns on and starts flashing a lot? That means it's actively recording your audio to the microSD card.

Tap the **REC** button again (or fire another trigger) and wait a moment until the **Busy** light goes off. Congratulations! You just made a sample! If you were to put the microSD card into a computer now, you'd see a new stereo WAV file with your sounds on it. But let's try playing it back first.

Levels: The STS is made for modular-level signals, but it does a decent job with line-level signals. (You can boost line-level to modular level digitally later using the **Edit+Gain** feature). However, for the best quality, use a suitable line-to-modular level converter module. Even a low-cost "input" module such as the **4ms Listen IO** will greatly increase the quality of line-level recordings from a phone, computer, guitar pedal, etc.

Where is my recording?
The sample you recorded is automatically loaded into whatever bank the **REC Bank** button was set and whatever slot the **RECORD Sample** knob was pointing to when you *started* recording. By default, the STS boots up with the **REC Bank** set to the first empty bank— this way it won't change your existing banks when you start recording. As you turn the **REC Sample** knob, the **REC** button will flash. If it flashes dim red, the slot is empty. If it flashes dim white, there's already a sample in the slot.

Jump to Rec Bank:
Hold both 0.5 sec
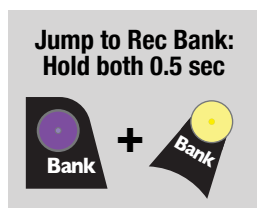
Teleport to the Rec Bank
To hear the sample you just recorded, we need to go to that bank in one of the play channels. You already know a couple ways to browse banks (tapping **Bank**, or holding **Bank** while turning the **Sample** knob), but let's learn a new trick for this: Hold down **REC Bank** and a play channel's **Bank** button for half a second. The play channel **Bank** will teleport to the **REC Bank**. You should see the play **Bank** button change color/blink to match **REC Bank**.

Now that you're in the right bank, turn the play **Sample** knob to match the **RECORD Sample** knob, and hit the **PLAY** button. You should hear your sample play back! Notice that when you turn the Sample knob on the play channel the play light blinks either red or white. Red means the slot is empty, and white means the slot has a sample.

Before you hit **REC** again, move the **RECORD Sample**

Monitoring: When you hit a **PLAY** button, Monitoring is disabled (the blue Monitor light will go off, and the **REC** button will turn purple). To turn Monitoring back on, hold the **REC** button for half a second.

knob to a new slot. Otherwise you'll record over the slot (the file will still be there, just not assigned to any slot).

Hold both 0.5 sec

Saving after power-down
By now you should have a few different new samples recorded into a few different slots. The WAV files themselves are saved on the microSD card, and the STS has assigned each file to a bank/slot. You should be familiar with how to play each sample you just recorded by going to the bank and slot number on a play channel.
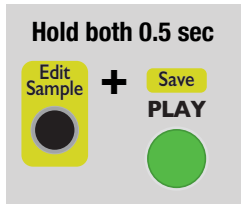
At this point, the information telling the STS which sample file is assigned to which slot in the bank is not saved to the microSD card. Keep in mind that the sample files themselves are saved, but the STS is only temporarily assigning them to the bank/slot you recorded them into. To make this temporary assignment permanent, you have to save it.

How it works: The STS never deletes or overwrites your files! When you make a new recording, the STS assigns the new WAV file to the sample bank/slot selected by the **REC Bank** and **Sample** controls. If you accidentally record into a bank/slot that already has a sample you wanted to keep, don't worry— the previous sample file is still saved on the card, but it's *temporarily* not assigned to any sample slot. If you don't hit **Save**, then the old file will be loaded next time you power on. Read the **Assigning Samples** section for more ways to re-assign samples to slots.

To save the sample bank/slot assignment information, hold down **Edit Sample** and the left side **PLAY** for half a second. The lights will flash a bit while it saves.

Notice the word "SAVE" above the left side **PLAY** button— it's written in gold just like the **Edit Sample** button to remind you of the alternate feature of this button.

Why doesn't the STS just save your sample slot assignment information automatically when you record? The reason is that you might have recorded over a slot that you didn't mean to, or you might not like any of your takes and decide not to keep them. If this happens, you can either use the **Edit**+**Revert**+**Bank** feature (see **Edit Mode** section), or re-assign the slot using the **Edit+Next File** feature (see **Assigning** Samples section)… or just do nothing and the next time you power on the STS, the samples will be back to the way you had them before.

## Tutorial 4: Loading Files onto the microSD Card

The STS has an intelligent and intuitive sample file management system. You can do everything in several different ways, depending on your preferences: use a computer to move files, or use the STS's on-board assignment feature, or edit the index file with a text editor (hackers only).

Unlike many other samplers, you never have to rename your files for the STS. You can simply drag your sample files into folders and the STS will load them into banks. This makes loading a huge sample library a breeze.

Included with your STS is a SD Card adaptor that fits any computer with a SD Card slot. If your computer lacks this slot, you need to purchase a microSD to USB adaptor.

First, make sure the **Busy** light is off, and power down the STS. Remove the microSD card and insert it into the adaptor in your computer. The microSD card should show up as a drive on your computer, similar to what's shown on the right:

Each of these folders contains WAV files. Think of each folder as a bank.
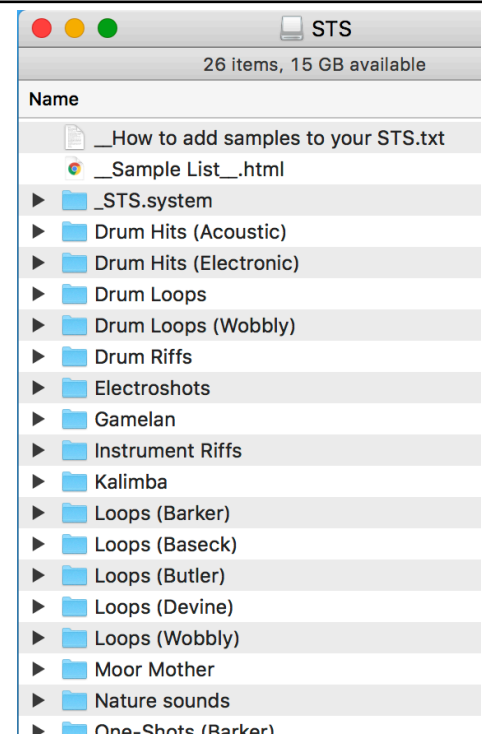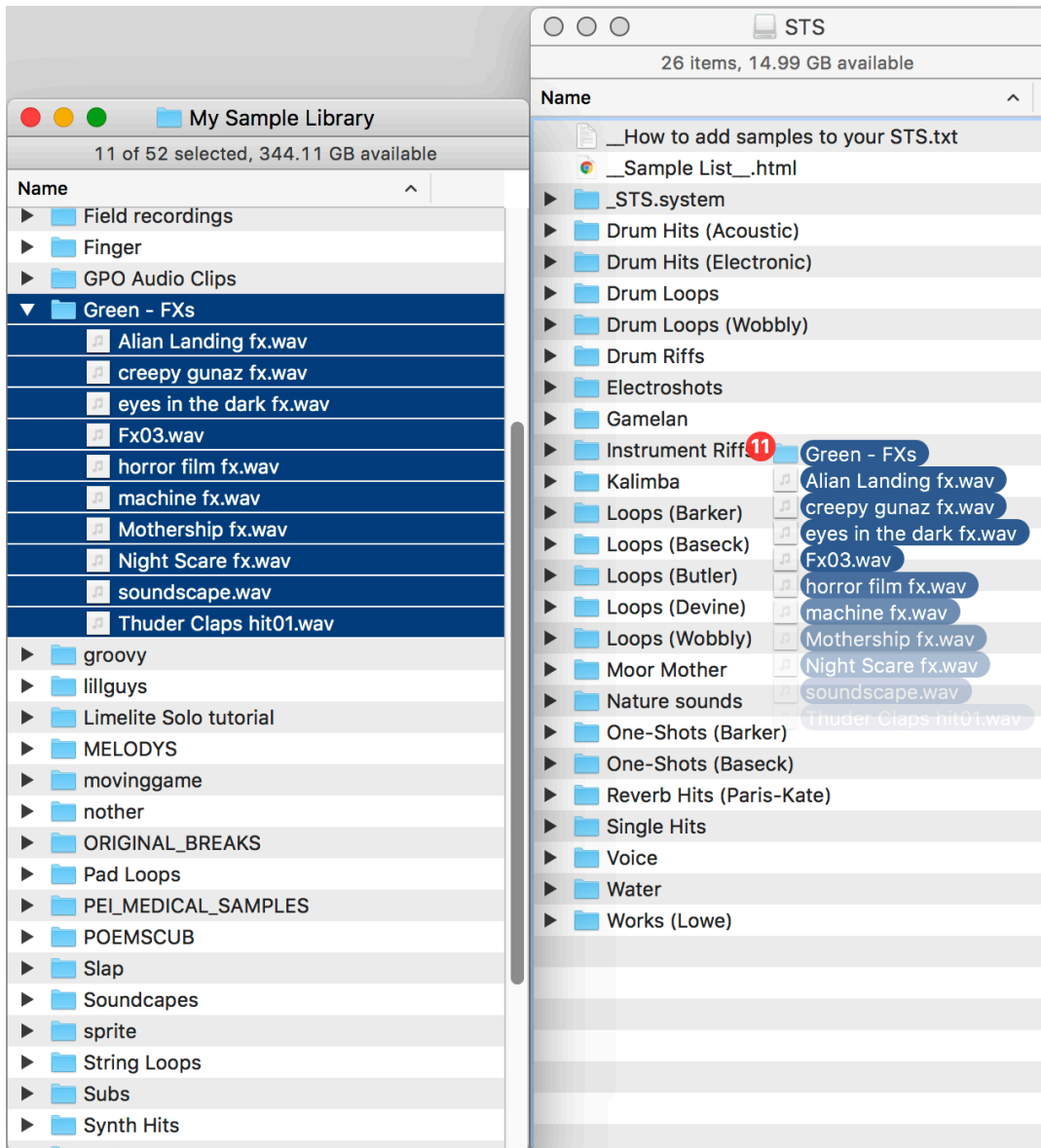
Above: copying a folder of 10 WAV files onto the STS microSD card. The folder starts with the word "Green" so it will get loaded into the Green bank. The files will be loaded in alphabetical order into slots 1 – 10.

Create a bank by copying a folder of WAV files

To create a new bank with your own samples, simply drag/copy a folder containing WAV files onto the root level of the STS microSD card. The WAV files must be directly inside the folder. Folders inside folders (sub-folders) will be ignored by the STS

You can copy as many folders full of WAV files as you like: only 60 banks can be loaded at once, but the other folders will still be accessible from the STS using the **Edit**+**Next File** feature.

You could also copy sample(s) to an existing folder. If the other samples in that folder are in a bank with less than 10 samples in it, the new file(s) will automatically be loaded into that bank. If there are no empty slots in the bank, then you can use the **Edit+Next File** feature to choose which samples you want to use.

If you remove a file from a folder, then the STS won't be able to find that file and will look for it. If it finds the file in another folder, it'll update the index to the new location. But if the STS can't find the file

anywhere, then it'll try to find a new file to fill that slot. The first place it will look is the original file's folder. What this means is that if you don't like a particular sample, you can delete the file and replace it with a new file. The STS won't find the deleted file, and it will load the new file instead. In complex cases, such as when you have banks containing samples spanning multiple folders, the STS will try to fill the empty slots in each bank by searching in the folder of the lowest-numbered sample's file location.

Folders with color names

If you name the folder starting with a color name from the list on page 7, the folder will automatically be loaded into the bank of that color! Example: "Orange - My Field Recordings" will be loaded into the Orange bank. What if there's already an Orange bank? It'll get bumped down to Orange-1 (that's Orange with one blink). And if Orange-1 exists, it'll get bumped down to Orange-2, etc…
Here are the valid color names:

White   Red   Orange   Yellow   Green   Cyan   Blue   Magenta   Lavender   Pearl

You can type the color names in ALL CAPS, all lower case, or with An Initial Capital Letter. After the color name you can write any ASCII characters. The STS does not support emojis or unicode ¯_(ツ)_/¯

Automatic loading of new/moved files

When you put the microSD card back into the STS and power it back up, the STS will recognize any new folders and will create a new bank for each one. The first 10 WAV files inside that folder (alphabetically) will be loaded into the 10 slots of the bank. If there are more than 10 WAV files in a folder, only 10 will be loaded, but the rest are still accessible using the **Edit**+**Next File** feature we'll talk about later. Remember, sub-folders are ignored, so only WAV files directly in the folder will be scanned.
Also, missing files will be searched for and/or replaced by new files inside existing folders.

Sample List HTML file

After you've made changes to the microSD card using a computer, the next time you boot the STS with that card, the module will create a file in the root level of the microSD card called
`__Sample List__.html`

This is a handy quick reference for seeing what files are in what banks and how long each sample is. So if you are ever wondering which samples are assigned to which slots in which banks, open this up and it'll tell you! You might even want to email it to your phone, or print it out so you have it nearby if you want to look something up.

`_STS.system` folder

Inside this folder are files that we officially ask you not to touch! With that warning out of the way, software engineers, hackers and curious-minded tinkerers may find an interest in opening the `sample_index.dat` file and `settings.txt` file in a text editor and seeing how they work. All features controlled by these files can be set using the STS without a computer — but if you're a reverse-engineering type person, you might enjoy looking "under the hood" to see how they work.


```
__Sample List__.html
▶ _STS.system
▶ Drum Hits (Acoustic)
▶ Drum Hits (Electronic)
▶ Drum Loops
▶ Drum Loops (Wobbly)
```

file:///Volumes/STS/__Sample%20List__.html

Firmware Version: 1.0

SAMPLE LIST

White

1] Single Hits/ChordHit_011.wav .... [00:03]
2] Single Hits/Buchla Bass.wav .... [00:01]
3] Single Hits/DevineSingleShotKick_001.wav .... [00:01]
4] Single Hits/DevineSingleShotKnock_002.wav .... [00:01]
5] Single Hits/DevineSingleShotFMRotor_008.wav .... [00:01]
6] Single Hits/DevineSingleShotFMTack_003.wav .... [00:01]
7] Single Hits/DevineSingleShotFMRolled_005.wav .... [00:01]
8] Single Hits/303 Snip 1.wav .... [00:01]
9] Single Hits/DevineSingleShotFMKlock_007.wav .... [00:01]
10] Single Hits/Space bowl 1.wav .... [00:08]

Red

1] Drum Hits (Electronic)/club-kick-0711.wav .... [00:01]
2] Drum Hits (Electronic)/kick-pack-0401.wav .... [00:01]
3] Drum Hits (Electronic)/club-kick-0806.wav .... [00:01]
4] Drum Hits (Electronic)/snare-02.wav .... [00:01]
5] Drum Hits (Electronic)/snare-04.wav .... [00:01]

Backup the `_STS.system/` folder onto your computer before making changes!
While no real damage can occur, the worst case is you could lose all your sample loop/trim points, gain settings, and bank/slot assignments. Your actual sample files will never be changed.
If you are familiar with editing configuration files, you can open the sample_index.dat file with a text editor. The syntax is strict, so make a backup before-hand.

Edit Mode: Gain, Loop/Trim points

You can edit some features of samples without using a computer. These edits do not change the actual WAV file, they just store loop points and gain information in a separate file for the STS to use.
All these features use the **Edit** button to modify the sample loaded into the left side. As a reminder of this, there's an arrowhead pointing left next to the **Edit** button.

The changes you make using the **Edit** features are not saved until/unless you tell the STS to save your changes. This way, if you goof up, you can always go back to how it was. Remember, your WAV files are never modified, the STS just stores the loop/trim points and gain settings in its own file.

Editing a sample: Gain
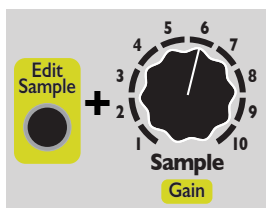
By holding down the **Edit** button and turning the **Gain** knob (right side **Sample** knob) you can adjust the gain of the sample being played.

At 0% the gain is set to 0.1, or 10% of the volume.
At 50% the gain is set to 1, which is the default.
At 100% the gain is set to 5, or 500% of the volume (clipping may occur!)

Try this out now: play a sample on the left side and hold **Edit** while you turn **Gain**. Hear how the gain changes. It can even make a sample clip or overdrive if you want to.

Gain vs. Volume: The gain setting stays with the sample, no matter which channel you play it on, as opposed to the Channel Volume feature which stays with the channel, no matter what sample you play.

Editing a sample: Loop/Trim start and stop points
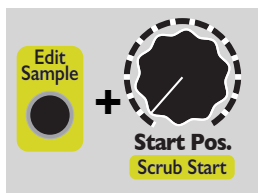
Similar to gain, you can also edit the maximum start and stop points of a sample. These are known as the Loop or Trim points, and are controlled using the **Scrub Start/End** feature.

Hold **Edit** and turn the right side **Scrub Start** or **Scrub End** knobs. The STS will scrub the start or end point of the sample as you turn the knob. The knob is velocity-sensitive, so turning it quickly will scrub a large distance, while turning it slowly will scrub a small amount.
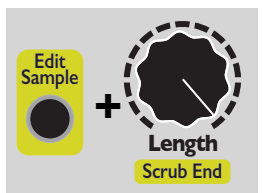
Release the **Edit** button when you're done scrubbing. To hear how the newly trimmed sample sounds, make sure you turn the left side's **Start Pos** knob to 0, and **Length** knob to 100% and then press the left side **PLAY**. If you want to adjust them some more, you can do **Edit**+**Scrub** again as much as you like.

Start Pos/Length vs. Scrub Start/End:
How is **Scrub Start/End** different than using the **Start Pos** and **Length** knobs? It has the same effect, but the difference is that the Loop/Trim points (**Edit**+**Scrub Start/End** points) can be saved after you power down. The **Start Pos** and **Length** knobs are limited in range by the Loop/Trim points: no matter how you CV and knob-twist the **Start Pos** and **Length,** it'll always stay within the Loop/Trim window. So you can effectively create a new sample by grabbing a short window from a long sample.

This is a very useful technique for creating loops, or isolating "hits" or parts from a longer sample. Example: you can isolate phrases or words from a speech or audio book, or you can create a drum loop from a pop song. Or split up a sample into a bunch of smaller slices. It's also useful for removing silence or noise from the beginning or end of a sample file.

Remember to Save your work! Your Loop/Trim points will be in effect as long as the STS is powered up. If you want to keep them after power down, you have to save them. Hold **Edit** and **Save** (left side **PLAY**) for half a second to save. After you save your start/end points, playing the sample will be limited to within those points, no matter how you set the **Start Pos** and **Length** knobs. You can always clear your loop points by holding **Edit** and spinning the **Scrub Start** knob rapidly to the left a handful of times, and then the **Scrub End** knob rapidly to the right a handful of times.

Saving and Reverting

Save: Hold 0.5 sec

Any changes you make using the Edit functions must be saved if you want to see these changes the next time you power the STS on. To save, hold down **Edit** + **Save** (left side **PLAY**) for half a second. Release the buttons when you see the lights change.

Undo: Hold 0.5 sec
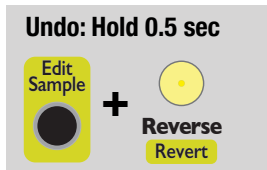
Undo changes to one sample
If you want to undo the changes you just made to a sample, hold down **Edit**+**Revert** (left side **Reverse**) for half a second. This will revert the currently selected sample.

Revert bank: Hold 2 sec
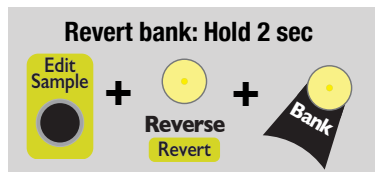
Revert one bank
If you want to revert a whole bank back to the last saved version, hold down **Edit**+**Revert** and the **Bank** button for that channel for two seconds. This will revert the currently selected bank to the last saved version.
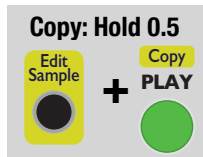
Revert all banks: Hold 4 sec
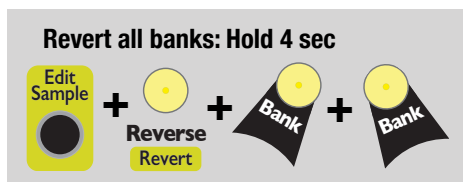
Revert all banks
If you want to revert everything back to the last saved version, hold down **Edit**+**Revert** (left side **Reverse**) and both **Bank** buttons for four seconds. This will revert the STS to the state it was when you last powered on (this is the same as flipping the power on and off, but it's much safer!)

Copying

Copy: Hold 0.5

You can copy a sample from one bank to another. Copying doesn't actually copy the file on the microSD card, it just assigns the file to multiple sample slots. It also copies the gain, and loop/trim points, but you can edit the gain or loop/trim points on each copy independently.
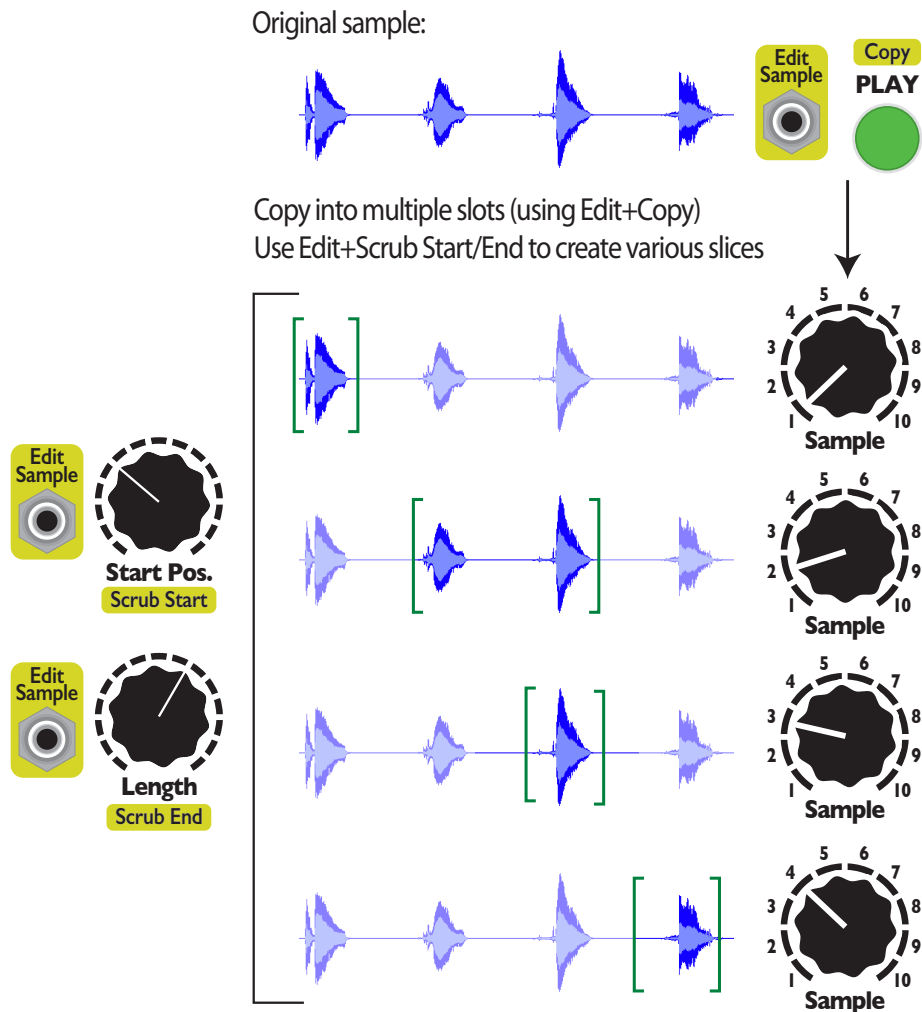
To perform a copy:
1. On the left side, go to the sample/bank you want to copy from.
2. On the right side, select the bank and sample you want to copy into (whatever sample is in that slot will no longer be assigned).
3. Hold down **Edit** and **Copy** (right side **PLAY**) for half a second.

Remember, the copy action happens from the left side to the right side. Whatever is in the right side before you copy will be bumped out. You have to save your changes after copying if you want them to appear the next time you power on (see "Saving and Reverting" section on previous page).

Copying is a powerful feature that allows you to create multiple instances of a sample. Example uses:
- Create a copy of a snare sound and set the **Gain** higher to produce an "accented" version.
- Copy a sample of a speech, and set the trim points on each copy to grab different words.
- Copy a sample you like to use a lot, and place the copies in multiple banks for easy access.
- Create a new bank of samples that are spread out around other banks.
- Turn one sample into several slices or loops.

Tutorial 5: Creating Slices

Original sample:

Copy into multiple slots (using Edit+Copy)
Use Edit+Scrub Start/End to create various slices

Start Pos.
Scrub Start

Length
Scrub End

Sample

Sample

Sample

Sample

You can combine Copying and setting the Trim/Loop points to create multiple slices of a sample, and store those slices into sample slots.
1. Go to the sample you want to slice up on the left side of the STS.
2. On the right side, go to the destination bank where you want to store the slices (see the "Navigating Banks" section for how to go to an empty bank).
3. Turn the right **Sample** knob to the slot you want to put the first slice in.
4. Now hold **Edit**+**Copy** (right **PLAY** button) for half a second. You just copied the sample from the left side to the right side!
5. Turn the right **Sample** knob to the next slot and hit **Edit**+**Copy** again. Repeat until you created enough copies.

Now we're going to set the loop/trim points on each copy:

6. On the left side, go to the same bank the right side is in.
7. Set the left **Sample** knob to the slot you want to edit.
8. Use **Edit+Scrub Start** (right **Start Pos** knob) and **Edit+Scrub End** (right **Length** knob) to scrub the beginning and end points.
9. When you found the start/end points you like, set the left **Sample** knob to the next slot and repeat step 8.
10. Don't forget to do **Edit**+**Save** if you want to save your work!

Example Patch: Sequencing the STS
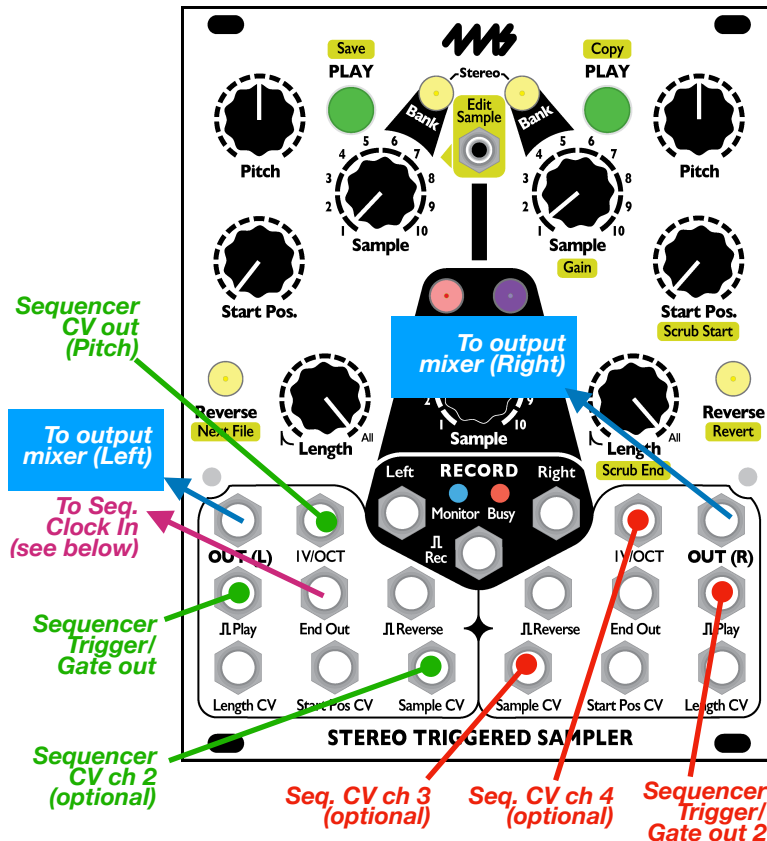
The STS works well with a standard CV/Gate sequencer. A typical patch is shown on the left.

The Trigger or Gate output of the Sequencer is patched to the **Play** ⎍ input of the STS. This makes the sample fire on each sequencer step. Some sequencers have gate repeat effects, which will make the STS fire a sample multiple times per step.

The CV output of the sequencer is patched to any of the CV inputs on the STS. If you want to use the sequencer to control pitch (playing a sample at various pitches), patch into the **1V/OCT** jack.

If you want a "multi-timbral" effect, patch the CV output into the **Sample CV** jack on the STS. Each step of the sequencer can trigger a different sample to play.

If you have a sequencer with 2 or more CV outputs, you can even sequence both pitch and sample selection at once!

Multi-voice, multi-timbral

Since the STS has two channels, you can use a sequencer with two trigger/gate channels to drive both STS channels with different rhythmic patterns. In Stereo Mode (see page 9) both stereo samples will be mixed together. Each side of the STS has its own CV jacks, so you can treat each side of the STS as an independent instrument, but both draw from the same collection of samples.

You can also select "slices" of a long sample by running the Sequencer into the **Start Pos CV** jack. Each step of the sequencer can thus play a different slice of the original sample.

STS as the clock source: End Out->Clock In
One variation of this patch is to use the STS itself to clock for the sequencer by patching **End Out** to the Sequencer's clock input. Make sure to set the sequencer to run on external clock.
To start the patch, hit **PLAY** on the STS once. The **End Out** will fire, thus clocking the sequencer, which starts a sample on the STS, which fires an **End Out** when it finishes, which advances the sequencer, etc… The **Length** control on the STS will control the tempo, which will vary with each step if the samples are of different lengths. Try this patch with the Sequencer CV out into the STS **Sample CV**.
*Note: if the patch seems to run for a moment and then stop, the gate pulse width on the sequencer is probably preventing it from firing new steps. Either reduce PW to triggers or hold **PLAY** on the STS for half a second to loop the STS channel.*

Clock Divided Reverse
Try splitting/mult'ing **End Out** and running it to **Reverse ⊓**. Or patch **End Out** into a clock divider and use the divisions to reverse playback every N steps! If you only have one side of the STS patched so far, patch other clock divider outputs into the **Play ⊓** on the other side.

Example Patch: Granular Scrubbing
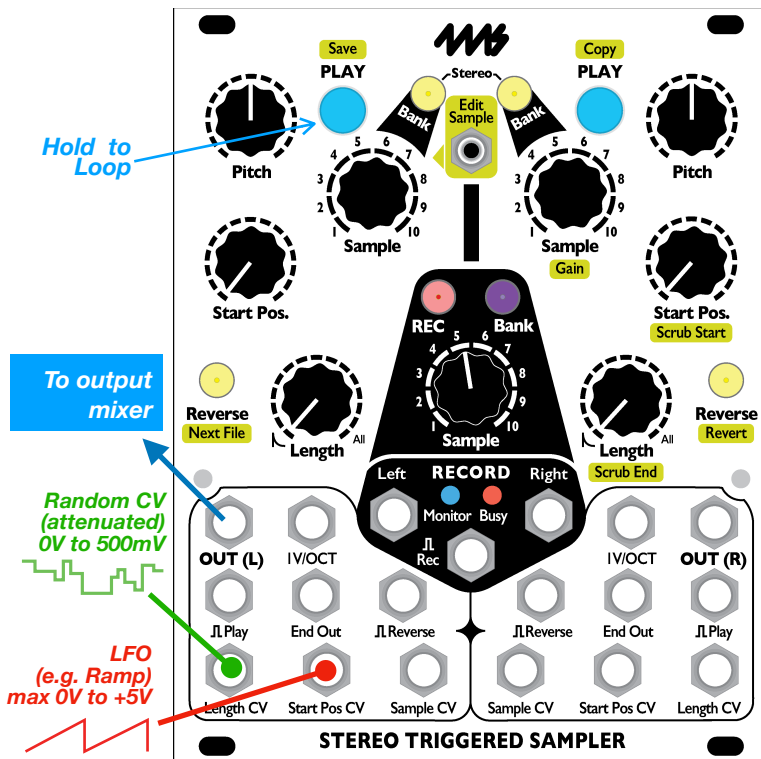
Since the STS can play fragments of a sample as small as 8 ms, it can be used for some basic granular synthesis techniques such as granular scrubbing. This can be used for a variety of sounds, including time-stretching (without changing pitch), and pitch-shifting (without modifying playback time).

The simplest way to play with granular scrubbing on the STS is to load a familiar sample: a drum loop or a vocal sample, perhaps. For starters, pick a sample that's between 1 and 10 seconds long.

1. Turn **Start Pos** and **Length** to 0%.
2. Hold **PLAY** to make the channel loop. You should hear a buzzy tone.
3. Slowly turn the **Start Pos** knob up, and listen how the sample is played (scrubbed). **Start Pos** essentially is sweeping the play head.
4. Now turn **Start Pos** down slowly. The sample should play backwards! Notice that no matter how fast you turn **Start Pos**, the pitch does not change. That is, you can play the sample faster or slower without changing its pitch. This is time-stretching in its most basic form.
5. Now turn **Length** up a tiny bit. Hear how the buzzy overtone changes? **Length** is setting the size of the grains.
6. Let's use an LFO to sweep through the sample so you don't have to do it by hand. Patch a very slow ramp-up LFO into the **Start Pos CV** jack. A **Pingable Envelope Generator** is great for this. The period of the LFO will equal the playback time, so make the LFO's period several seconds long. Make sure the **Start Pos** knob is back at 0. For full range, the ramp-up LFO should be 0V to +5V: Set the PEG's Scale knob to 3:00 and Bi-Polar off. Attenuate or shift as needed: any voltage under 0V or over +5V will make playback "hang". When the LFO is exactly 0V to +5V, you should hear the entire sample being played forwards. Adjust the LFO speed to adjust the playback speed.

Also, you can attenuate the LFO and/or adjust the **Start Pos** knob to select certain portions of the sample to playback.

7. Try different LFO wave shapes: ramp-down will play the sample backwards, triangle will play it forwards-backwards, curved waves will play it at variable speeds (constant pitch).
8. Next, let's get rid of that buzzy overtone. Patch a random LFO (or a simple triangle if you don't have a random source) into an attenuator module. Attenuate the signal heavily, down to about +0.5V max. Patch the attenuated random LFO/noise into the **Length CV** jack. Make sure the **Length** knob is turned all the way back down. The overtone should now be randomized enough that it disappears. Adjust the attenuation and/or random speed and/or **Length** knob to suit your taste.
9. To change pitch without changing the playback time, simply adjust the **Pitch** knob (or use the **1V/OCT** jack). Since the playback time is set by the LFO in **Start Pos CV**, you can freely adjust **Pitch** without changing the timing. Likewise, you can adjust the playback timing without adjust the **Pitch**.

Random Grains
Scrubbing involves playing the grains in order, but you also can play grains in random order. Patch the random LFO into **Start Pos CV** instead of **Length CV**, and don't attenuate it as much (or at all). Then you can leave **Length CV** unpatched, or patch some other LFO into it to vary the grain sizes.

Recording the STS Output as a New Sample

To output mixer (Left)

To output mixer (Right)
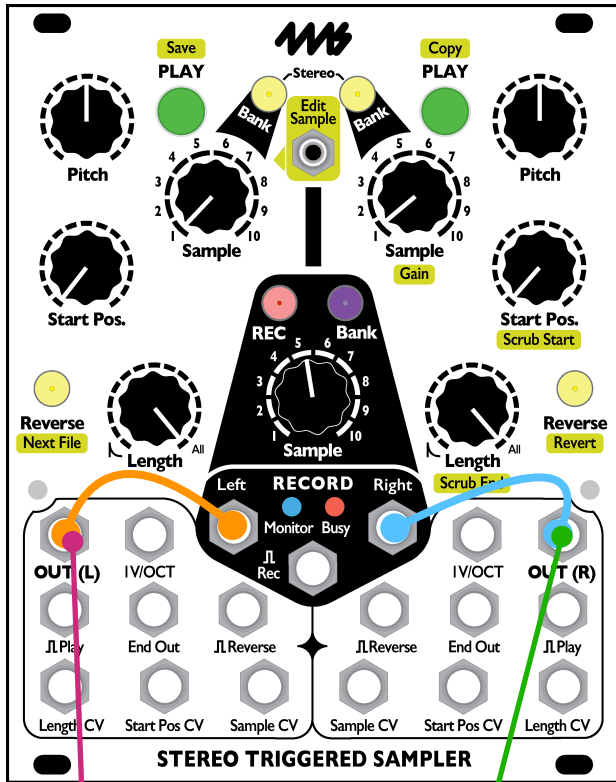
With some skillful button taps, knob twists, and thick CV lines, you can turn any pack of samples into an original creation worthy of being its own sample!

Since the STS can record and playback simultaneously, this is easy to do: you just need to patch the outputs into the inputs and record as normal.
A couple things to keep in mind:

1) To listen as you record, split or mult the outputs: one cable running to the **RECORD** input jacks, and one cable running to your mixer. See diagram at right. A passive mult or a "stackcable" will work.

2) When you arm recording, the STS automatically turns Monitoring on. This will create a feedback loop (out->in->out). Luckily, as soon as you press **PLAY**, the STS disables **Monitor**ing. If you hear a feedback sound starting to emerge, hit either **PLAY** button to disable **Monitor**ing. It's best to arm recording before perfecting your patch, in order to avoid feedback completely

Example Patch: Clock Sync and Shifting Ping-Pong Loops
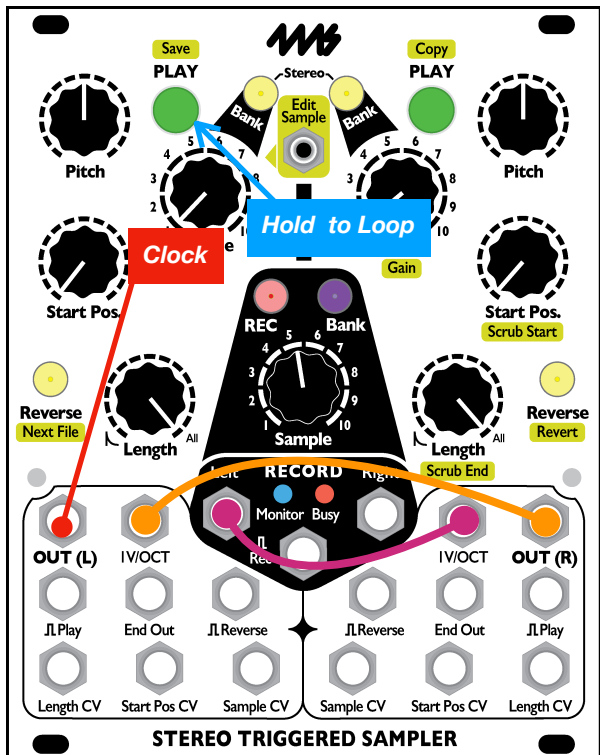
Find a sample with rhythmic elements. Hold **PLAY** to make it loop. Turn down **Length** to between 50% and 90% to make a shorter loop that you like.

Clock Sync:
Run a clock into **Play** ⊓ to sync the loop to the clock. If the loop is shorter than the clock, the sample will loop until the next clock.

Shifting Loop:
Patch a very slow LFO into **Start Pos CV**. Each time the loop ends, it'll start in a new position, based on where **Start Pos CV** is *at the moment the sample re-starts.*

Ping-Pong:
On the left side, patch **End Out** into **Reverse** to play the loop forward/backwards/forward/backwards

Dual Ping-Pong:
Patch **End Out** of the left side to **Play** ⊓ of the right side. Then patch **End Out** of the right side to **Reverse** ⊓ of the left. Loop both sides if you like.

Assigning Samples to Banks and Slots

Re-assign current slot:
(Next File)

Edit Sample + **Reverse / Next File**

Re-assigning samples to slots

You can change which sample file is assigned to a bank/sample slot. On the left side channel, go to the bank and sample slot you want to change. Hold **Edit** and tap **Next File** (left side **Reverse**). A new sample will play. If you keep tapping **Next File** with **Edit** held down, it will keep playing new files, scanning the microSD card for WAV files, and playing them one by one, in this order:

▼ 📁 Drum Hits (Electronic)
   🎵 bell-0105.wav
   🎵 club-kick-0608.wav
   🎵 club-kick-0711.wav
   🎵 club-kick-0805.wav
   🎵 club-kick-0806.wav
   🎵 club-kick-0807.wav
   🎵 club-kick-0808.wav
   🎵 kick-pack-0401.wav
   🎵 snare-02.wav
   🎵 snare-03.wav
   🎵 snare-04.wav
   🎵 tom-0103.wav
   🎵 tom-0104.wav
   🎵 tom-0105.wav
   🎵 zg-hat-02.wav

Files in current folder
(alphabetically)

Unused WAV files
(scans entire card)

Sample 1 → 2 → 3 → 4 → 5 → 6 → ...
Sample 1 → 2 → 3 → 4 → 5 → 6 → ...
Sample 1 → 2 → 3 → 4 → 5 → 6 → ...
Sample 1 → 2 → 3 → 4 → 5 → 6 → ...
Sample 1 → 2 → 3 → 4 → 5 → 6 → ...
Sample 1 → 2 → 3 → 4 → 5 → 6 → ...
Sample 1 → 2 → 3 → 4 → 5 → 6 → ...
Sample 1 → 2 → 3 → 4 → 5 → 6 → ...
Sample 1 → 2 → 3 → 4 → 5 → 6 → ...
Sample 1 → 2 → 3 → 4 → 5 → 6 → ...

Repeat from start

All samples in all banks
(normal order)

Re-assign current slot:
(Previous Bank)
Hold 2 sec

Edit Sample + **Reverse / Next File**

Next File/Previous bank
Next File: Tap the **Next File** button while holding down **Edit**
Previous Bank: Hold **Edit**+**Next File** for about two seconds. If you're in the middle of a bank, it will go back to the beginning of the bank, and if you're already at the beginning then it'll go to the beginning of the previous bank.
Scan All Banks: Hold **Edit**+**Next File** continuously. The first file from all banks will be played, one after another, until you let go.

All the files in the current folder plus the unused files on the card (left and middle columns of the diagram above) are treated as a "bank". This imaginary "bank" is inserted into the normal order of banks before the White bank. So if you're in the White bank and you go back, it'll go to this "bank", and if you go back from this "bank", it'll go to the last bank that has samples in it.

Tip: Give your finger a break! During any of these button presses, you can release the Edit button at any time, and pick back up where you left off.

The color of the **Next File** button helps you know where you are in the diagram above:
In the first column (all files in the folder) the button will flash the current bank's color.
In the second column (all unassigned files) the button will flash dim white.
In the last group (each bank) the button will be the color and blink of the bank you're in.

You have to save with **Edit**+**Save** to have the changes take effect after you power the STS off. If you don't save, you can hit **Edit+Revert+Bank** to restore to the latest saved version without having to power down.

Uses for the *Edit+Next File* feature
Being able to re-assign samples to different banks and slots is a powerful feature that allows you to organize your samples on the STS even if no computer is available.
• Create a bank of samples you want to use for a session.
• Change the order of samples within a bank.
• Record multiple takes and choose which one you like.
• Move new recordings to different banks.
• Choose samples you want to use from a folder of more than 10 samples.
• Have more than 600 samples on a microSD card and select which ones you want to use without using a computer.
• Searching for a sample if you can't remember what bank it's in.

Assigning samples walk-through
Let's do an example. The sample pack that ships with the STS has 15 files in the "Drum Hits (Electronic)" folder. Let's try picking a different sample for sample slot #1:
1. On the left side play channel, go to the Red bank.
2. Make sure **Length** is set to 100% and **Start Pos** is 0% in order to listen to the entire sample.
3. We're going to re-assign slot #1, so turn the left side **Sample** knob to 1.
4. Hold **Edit** and tap **Next File** (left side **Reverse** button). A new sample file will play. Notice that the left side **Reverse** button flashes red (since you're in the red bank).
5. Hold **Edit** and tap **Next File** some more times and listen to how it plays a different sample each time. When you find one you like, stop hitting **Edit**+**Next File.**
6. That's it! You've now re-assigned the Red bank slot #1 to whatever sample you picked.

Try it out: move the **Sample** knob to "2" hit **PLAY**. Now move it back to "1" and hit **PLAY** again: it should play the new sample you picked out! You can repeat this process for slot #2 and the rest of the Red bank, putting any sample (from anywhere on the microSD card) into any slot.
Like all other **Edit** button features, your changes will get lost if you power down without saving. (Remember: to save hold **Edit** + **Save** [left side **PLAY**] for half a second).

Let's continue the walk-through and browse all the samples on the microSD Card:
7. Go to a sample slot you haven't re-assigned yet. Hit **Edit+Next File** until the **Next File** button changes color from flashing red to flashing dim white. The flashing dim white indicates it's no longer scanning the folder, and instead is now scanning the entire microSD card for WAV files that aren't being used in a bank somewhere. The sound that you just heard played was a sample file that's not assigned anywhere.
8. If you keep hitting **Edit+Next File** the STS will keep scanning the card for unused samples. There are a few dozen of these in the sample pack, feel free to browse!
9. Once the STS has scanned the entire card (excluding sub-folders, of course), it will move on to playing the banks. The first bank is White with no blink, so the **Next File** button will turn White (no blinks). As you keep hitting the button, it'll play all 10 samples in the White bank, then move on to the 10 samples in the Red bank, then Orange, etc…
10. If you kept going through all the banks, you would end up where you started, playing the samples in the original folder (and the **Next File** button will flash red like it did when you started). At that point you will have played every single WAV file on the microSD card (excluding sub-folders, of course).

Tip: When you first hit Edit+Next File, it starts scanning the folder of the sample that's currently assigned to the slot. But— if you assign a new sample from a *different* folder to the slot, the next time you hit Edit+Next File on that slot, it'll start you in the new assigned sample's folder. Keep in mind the position of Edit+Next is retained until you change banks, so this only happens if you leave the bank and come back.

11. Try going backwards: hold down **Edit** and **Next File** for 2 seconds. If you're in the middle of bank or group, the STS will go to the start and begin playing the first sample. If you hit it again (or keep holding it down) it will go back a bank/group and play the first sample of the previous bank/group. If you hold it down for a while, it'll scan all the first files in every bank.

System Mode

Play/Recording Settings

To enter System Mode, hold down six buttons: both **PLAY** buttons, both **Reverse** buttons, **REC**, and **REC Bank** for 2 seconds. The lights will change and you can release the buttons.
There are several features you can change here by tapping some buttons:

Left **PLAY** button	
Blue: **PLAY** buttons act as start/re-start sample	Red: **PLAY** buttons act as start/re-start unless **Length** is at 100%, then they act as start/stop

Right **PLAY** button	
Green: changing to a new sample never interrupts playback	Red: changing to a new sample always stops/restarts playback
Blue: changing to a new sample restarts playback only when looping	

REC button	
Blue: Record at 24 bits	Orange: Record at 16 bits

REC Bank button	
Orange: Record at 44.1kHz	Yellow: Record at 48kHz
Cyan: Record at 88.1kHz	Blue: Record at 96kHz

Note: Your SD card must be fast enough to handle higher bandwidth recording rates. We recommend not using the STS for playback while you record at 88.1kHz or 96kHz, or at 24 bits.

Bank button (both channels)	
Blue: **1V/OCT** jack is quantized to semitones	**1V/OCT** jack is not quantized (default value)

*Note: The setting only effects the jack, not the **Pitch** knob.*

Left **Reverse** button: envelope applied to playback	
Orange: Both envelope types enabled (default)	Yellow: Fade in/out envelopes disabled. Percussive envelopes enabled.
Red: Fade in/out envelopes enabled. Percussive envelopes disabled.	Off: Both envelope types disabled.

Note: You can also apply this setting outside of System Mode, see Advanced Features section (page 27).

To save your changes, hold down **Edit** and **Save** (left side **PLAY**) for half a second.

To revert back to how it was before you entered System Mode, hold down **Edit** and **Revert** (right side **Reverse**). To exit without saving, hold down the same buttons you used to enter system mode, but only for a moment. If you hold them for 2 seconds or more, it will save your changes and exit.

LED Color Adjustment Mode

You can fine-tune the colors of your LED buttons in System Mode. This is especially handy if you have trouble telling the bank colors apart, or if the two Bank buttons have slightly different hues.

All new STS units shipped with v1.5 firmware will be factory calibrated. If you have an earlier STS, or if you wish to fine-tune your unit, you can follow this procedure:

1. While in System Mode, hold down both **PLAY** and both **Bank** buttons for two seconds, and release when you see the lights change color. The lights will turn red, green, blue, and then white.
2. Tap a button to select it for editing and adjust the red, green, or blue components by turning these knobs:

    • Adjust the Red amount using the **Length 1** knob

    • Adjust the Blue amount using the **Rec Sample** knob

    • Adjust the Green amount using the **Length 2** knob

3. At any point, you can also tap the **Edit** button to cycle through the 10 bank colors This is useful for checking your work (especially with the Bank buttons).
4. *Note: It's important to match the colors of the small buttons to each other. It's also important to match the colors of the large PLAY buttons to each other. However, it's not so important to match the colors of the PLAY buttons to the small buttons.*
5. To save your work, press and hold Edit + Play 1 (Save) for two seconds.
6. If you want to cancel your work, you can safely power cycle the module.
7. If you want to preview your work without saving, press **Edit** + **Reverse** 2 (Revert) for two seconds. You'll be able to play the STS normally with your new colors, but when you power down, your changes will be lost. If you decide you like your new colors, make sure to go back to LED Color Adjustment mode and save your work before powering down.

What version is my STS?

While in system mode, press and hold the **Edit** button. Look at the color of the left and right side **Reverse** button lights:

•	Left Reverse = **White**	Right Reverse = **Green**	➝ 1.5	*(latest version)*
•	Left Reverse = **White**	Right Reverse = **Yellow**	➝ 1.4	
•	Left Reverse = **White**	Right Reverse = **Orange**	➝ 1.3	
•	Left Reverse = **White**	Right Reverse = **Red**	➝ 1.2	
•	Left Reverse = **Orange**	Right Reverse = **Orange**	➝ 1.0 or 1.1 *(see note below)*	

*Note: if both **Reverse** buttons stay Orange when you press **Edit**, you have v1.0 or v1.1. To tell the difference press and hold the left **Reverse** button. If both **Reverse** button lights turn white, you have v1.1. If they remain orange, you have v1.0.*

1V/OCT Tracking Compensation

The **1V/OCT** jacks on the STS follow the 1 Volt = 1 Octave standard, however there is much variation in Eurorack due to impedance differences, un- or poorly-calibrated modules, passive mults/splitters, buffered mults with non-unity gain, etc. To stay in tune despite all these issues, the STS can be calibrated on the fly to match or tune to any other device. Doing this is easy and can even be done while performing. Each **1V/OCT** jack can be calibrated separately or together: whichever channel(s) are currently playing will be adjusted when you do the following button presses:

 Edit + **REC** *decreases* the tracking factor by -0.001V/oct
(whichever channel(s) are currently playing will be calibrated)

 Edit + **REC Bank** *increases* the tracking factor by +0.001V/oct
(whichever channel(s) are currently playing will be adjusted)

To calibrate a channel's **1V/OCT** jack to a particular CV (from a sequencer, perhaps), patch the CV signal into the **1V/OCT** jack and loop a sample on that channel. While the channel is playing, hold down **Edit** and repeatedly tap the **REC** button. With each tap, the tracking will drop. If that's making it go more out of tune then keep holding down **Edit** and start tapping the **REC Bank** button instead. Keep tapping the **REC** and/or **Rec Bank** buttons until it's in tune. You can repeat for the other channel, just make sure to stop playback on the first channel or else you'll end up re-calibrating it! The **1V/OCT** tracking compensation values will be active as long as the STS stays powered on. This is perfect if you just want to tune to a friend's old analog synth that seems to never stay in tune for more than an hour… but you don't want your STS to keep tracking like that when you're back in your studio. If you *do* want to save the tracking, just hold **Edit**+**Save** for half a second, and the tracking info will be saved to your unit after you power down. Tracking info is saved to the module, not the microSD card.

The tracking can be reset to 1.0000 simply by holding down all three buttons **Edit+REC+REC Bank** for two seconds.

Calibrate 1V/OCT jack offset
If there is a difference in pitch between the audio being recorded/monitored and playback of the same audio, or if there's a difference in playback pitch between channels, then this may need to be adjusted on your unit. Note that if the difference in pitch is heard in response to different voltages on the **1V/OCT** jacks, then the issue is probably with tracking compensation, not with offset (see above).

To adjust: Unplug the **1V/OCT** jacks. Double-check the **Pitch** knobs are centered in their detents. Set the channel you wish to adjust to looping playback. Make sure the other channel is not playing.

 Edit+Bank+Bank+REC decreases the offset.
(whichever channel(s) are currently playing will be calibrated)

 Edit+Bank+Bank+REC Bank increases the offset.
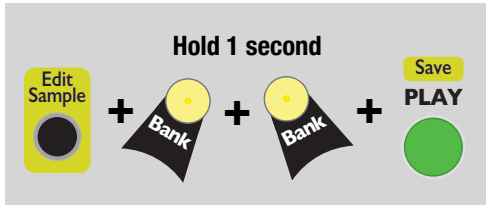*(whichever channel(s) are currently playing will be adjusted)*

The setting can be saved to the module by holding **Edit + PLAY (Save)** for 2 seconds.

Advanced Features

Start-up banks

You can set the default bank to be loaded at start-up.

Hold down **Edit + Bank 1 + Bank 2 + left PLAY (Save)** buttons for one second. The current bank selections on both channels will be saved as the default after power-on.

Adjustable Fade Time (Smoother Looping)

The STS performs a fade-down and fade-up at the end and beginning of playback when looping. You can adjust the amount of fade time from 0.36ms to 250ms. The default value is 24ms, which has been found to remove clicking without causing a noticeable "fade" effect.

To adjust the Looping fade time, hold down Edit while turning the left side Length knob. The PLAY buttons will flash white rapidly while you turn the knob. If you turn Length all the way down, the fade time will be 0.36ms. This value will increase as you turn the knob up, until it reaches a maximum of 250ms when the knob is fully clock-wise. The default value is 24ms, which is about 8 o'clock.

Auto Increment Sample Slot on Record Mode

This feature allows you to fill a bank with ten samples recorded consecutively, without moving the **Record Sample** knob manually.

When enabled, the STS will automatically increment the **Record Sample** slot number each time you finish a recording that was started with the **Rec Trigger** jack. When it gets to slot #10, it wraps back to slot #1. If at any time you turn the **Record Sample** knob, it'll reset the slot number to wherever you turned the knob.

A typical way to use this would be to press **Rec Bank** to enter empty bank. Turn **Rec Sample** to 1. Then start playing audio into the **RECORD** jacks. Make sure recording is armed (hold down the **REC** button for one second). Patch a trigger signal into the **Rec** Trigger jack (perhaps from a manual foot switch, or a period clock/gate signal). The first time the STS receives a trigger, it'll start recording into slot 1, and the next trigger will make it stop. The next two triggers will make it start and stop recording into slot 2. The next two triggers will make a recording into slot 3, etc. When it gets to slot 10, the next two triggers will make it record into slot 1.

Note that if you use the **REC** button to start recording, this feature will have no effect: you must use a trigger to start the recording for the slot number to increment when the recording stops.

To enable this mode, power down the STS and insert the SD card into your computer. Open the settings.txt file (located in the _STS.system folder) with a text editor. You should see these lines at the bottom:

```
[AUTO INCREMENT REC SLOT ON TRIG]
No
```

Edit the word No and change it to Yes. Save the file (make sure it's saved as text-only, not as RTF or anything else). Then eject the card and insert it back into the STS.

Envelopes on/off
The STS can apply two types of envelopes to sample playback, both these types can be turned on/off independently.

- **Percussive envelopes**: this is the decay envelope applied to playback when **Length** is less than 50% (if **Reverse** is on, it's an attack envelope). This envelope gives the playback a "percussive" sound.
- **Fade in/out envelopes**: this is a very short envelope applied to the beginning and end of playback when **Length** is over 50%. It reduces clicks when starting, stopping, or looping, especially when starting or ending in the middle of a sample file.

Turning off Percussive envelopes is often preferred when doing "Granular" patches (see Example patches). Turning off Fade in/out envelopes is sometimes interesting if you want to introduce the click of a loop as an audio artifact. Turning off both types of envelopes is recommended when playing CV sample files (.wav files with clocks/gates, sequencer CV, or slow LFOs, etc).
To toggle the envelope modes:

Percussive Env on/off:
Hold with knob @ 0
Reverse
(left side)
Length   All
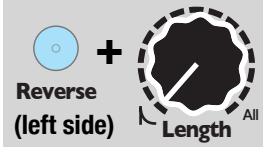
Percussive envelope mode toggle:
Turn left side Length to 0%. Then press left side **Reverse** for 2 seconds. Both **Reverse** button lights will flicker yellow when the envelope mode is disabled, and fade-up yellow when the mode is enabled.

Fade in/out Env on/off:
Hold with knob @ 100%
Reverse
(left side)
Length   All
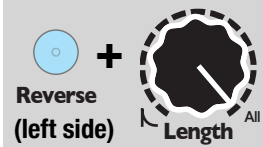
Fade in/out envelope mode toggle:
Turn left side **Length** to 100%. Then press left side **Reverse** for 2 seconds. Both **Reverse** button lights will flicker red when the envelope mode is disabled, and fade-up red when the mode is enabled.

You also can change the envelope modes in System Mode (see page 23)

Variable Trigger Delay / Latency
You can enable a Trigger Delay for the **Play Trig** jack. This adds a 0 - 14ms delay after a trigger is received on the **Play Trig** jacks. This feature is useful to compensate for slew/lag when using a CV sequencer with the **Sample CV** and/or **1V/OCT** jacks. The STS will read the voltages on the **Sample CV** and **1V/OCT** jacks after the Trigger Delay period. Adding this extra delay allows for the voltage to "settle". On early PCB versions (v1.0a) there's a small amount of slew on the **1V/OCT** jack's response due to the STS's hardware. Adding some trigger delay can reduce or eliminate this extra slew.

Edit Sample
Sample
RECORD
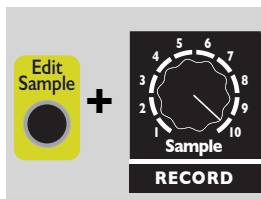
To set the Trigger Delay, hold down **Edit** and turn the **RECORD Sample** knob. The knob's numbers (1-10) correspond to a trigger delay amount. With the knob at 1, there is no delay. With the knob at 10, there is maximum delay (about 14ms in PCB 1.0a, and 8ms in PCB 1.1). The setting applies to both channels.

If you wish to have the least amount of latency, set this to "1". If you wish to have the maximum amount of compatibility with all sequencers, set this to "8" or above. The default value is "8".

The Trigger Delay is saved automatically in the settings file on the microSD Card, and will be loaded after power-on.

A bit of technical explanation regarding latency: Each sample slot (1-10 on the left side and 1-10 on the right side) has its own ultra-fast RAM cache that's about 6 seconds. Once the samples in the bank have been loaded into the cache, you can trigger any of the 10 samples in a bank (20 samples if you count both sides) with very low latency. The only limitation is that only the first 6 seconds of a sample file is loaded into the cache (the 6 seconds start at the **Start Pos** position). The process of loading into the cache typically adds 5ms to the latency, on the *very first time* a sample is played after changing banks. After the sample has been played once, the latency will be 0.7ms for all future times. You can tell that a sample has already been loaded because when you play it, the **Busy** light doesn't turn on.

Pro tip: If you play a sample and then move the **Start Pos** more than +/-6 seconds, the sample file data starting at the new **Start Pos** will have to be loaded into the cache again. If you require faster latency while still being able to select multiple start points greater than 6 seconds apart, consider using the **Edit+Copy** and **Edit+Scrub Start/End** features to create multiple copies of a sample with different start/end points.

Split Monitoring
The left and right channels can be independently monitored. To use this feature, you must be in Mono mode (see Stereo/Mono Mode, page 9). Start monitoring as normal (hold **REC** button for 2 seconds). The **Monitor** light will turn solid blue. Then, press **PLAY** on the channel you wish to stop monitoring. The **Monitor** light will go from solid blue to blinking to indicate "split monitoring": the channel for which you pressed **PLAY** will stop monitoring, and the other channel will stay monitoring.

A typical patch that uses split monitoring would be to record the mono playback of the right side, while monitoring it. To do so, monitor the left side only (exit monitoring mode on the right side), and patch this:

      OUT (R) -> Left RECORD In   **OUT (L) -> mixer/speakers**

Rebuilding the Index File

The STS keeps track of the loop/trim points, gain, and name of the sample file assigned to each bank/slot in a file called sample_index.dat (aka "the index file"), located in the _STS.system folder. If you wish to revert the STS to the factory organization, there is a factory original file located in a folder within the system folder, follow the instructions in the "How To" text file in that folder.
If you wish to clear all file organization and loop/trim points, you can simply delete the index file (back it up first, please!). Alternatively, you can boot with both **Reverse** buttons held down. This action cannot be un-done; the STS will forget and rebuild all sample organization information.

Updating Firmware (Audio Bootloader)

You can update the STS firmware by playing a special audio file into the **Record** jack. When new firmware versions are released, the firmware audio files can be downloaded at http://4mscompany.com/sts.php . Check/Follow/Like the 4ms Twitter, Facebook, or Instagram social media feeds to be notified of firmware upgrade availability, or email us through our website if you prefer to be on a mailing list.

1. To enter bootloader mode, first unplug all cables.

2. Enter System Mode as described above (hold down both **PLAY**s, both **Reverse**'s, **REC** and **REC Bank** for two seconds). Release those buttons.

3. While in System Mode, hold down left side **Bank**, right side **Bank**, **REC**, and **REC Bank** for four seconds. Keep holding them down until the lights change. Release the buttons.

4. The left side **PLAY** button should be green. If the left side **Reverse** button is green, tap it once to restart the bootloader. If you got here by mistake, you can exit the boot loader by tapping the **PLAY** button when it's green. The **Monitor** and **Busy** lights should be flashing and alternating.

5. Connect a computer or smart phone audio output to the **Left Record** jack. Either a stereo or mono cable is fine. Remove your phone case, it may be preventing the cable from fully plugging in.

6. Connect the **OUT(L)** jack to an amp/speakers so you can listen. You may hear some background noise that comes and goes, that's normal. Turn the amp/speaker volume down: this is going to be LOUD!

7. **Set the computer/phone's volume to 100%** and the audio player software to 100% volume. Turn off all audio and vibrate notifications (use Airplane mode). Close any applications that make notification sounds such as Facebook.

8. Begin playing the file. Immediately you should see the white LEDs and the **Busy** and **Monitor** LEDs flash a bunch. The buttons will also start to light up in colors, one by one.
   You should be hearing the sounds very loudly out the **OUT(L)** jack.

9. If the sound stops before the file is done playing, there was an error. The **Reverse** light will turn green and the four LEDs will turn on.
   a. Stop the file and rewind to the beginning.
   b. Check all cables are plugged in tightly.
   c. Tap the **Reverse** button. It should turn off and the **PLAY** button will turn on green again.
   d. Play the file again from the beginning.

10. If the file loads successfully, the STS will beep a few times and then boot.

Tip: some audio cards play a pop when they first start playing a file. If this happens, the Reverse light will trip as soon as you start playing. One way to overcome this is to hit the Reverse light immediately, before the noise starts playing (there's a 2 second lead time of silence). Or a better way to get around this is to use a different device (phones seem to work better than computers).

Tip: Do not play from fancy software like Ableton. We have seen that some software will alter the playback, which is not desirable here. Play from simple basic software such as VLC, QuickTime, Windows Media Player, or Chrome. Turn off any EQ or "Bass Boost" settings.

The open-source licensed source files (in C, for compiling with gcc-arm) can be found at https://www.github.com/4ms/STS

microSD Card Specifications

- We include the ideal type of card to use with the STS. If you need to buy an additional card, we highly recommend that you purchase the same class of card. The STS works best with a UHS Speed Class 3 card (also known as U3, which is the fastest of the UHS-I type cards).

    - Look for this symbol printed on the card: **3**

- Example card: *SanDisk Extreme microSDHC UHS-1 Card* (advertised as "Read up to 60MB/sec, Write up to 40MB/sec")
- If "UHS Speed Class 3" is not available, a "Class 10" card is acceptable (booting will be slower, and there may be more latency when playing 96kHz/32-bit/stereo files at high Pitch settings)
- A Class 10 card will be slower than a UHS Class 3 card. A class 6 or class 4 will be even slower than the class 10. If you are not using the STS to record while simultaneously playing, and you only playback 44.1kHz/16bit samples, then even the slowest microSD Card available will work fine. However, we still recommend purchasing a high-quality microSD Card, as cheaper cards are not as reliable and may result in loss of your data.

- See https://www.sdcard.org/developers/overview/speed_class/ for a discussion on micro SD Card speeds and labeling
- **Never remove the microSD card while the Busy light is on.** It's OK to remove it if the Busy light is off. Once a sample is played, it can be played again without accessing the SD Card (unless you change samples/banks or the sample window is longer than 30 seconds). You can hot-swap cards this way, but you must do a "Revert All Banks" button action if you insert a completely new card.

How to prepare a new microSD Card

- Purchase a UHS Class 3 card (see above)
- Format the card as ExFAT (preferred) or FAT32 (acceptable). See screenshot (right) for how to set MacOS standard "Disk Utility" program.
- Verify all sample files are valid WAV files (see file format specifications on next page)
- Put your WAV files into folders to organize them into banks (preferably 10 WAV files per folder)

    - Each new folder found will represent a bank. You can name the folders beginning with the name of a color (such as "Yellow-field recordings") to force that folder to load into a particular color bank.

    - Sample files must be located directly in the root directory, or in a folder. Folders inside folders (sub-folders) are never scanned by the STS.
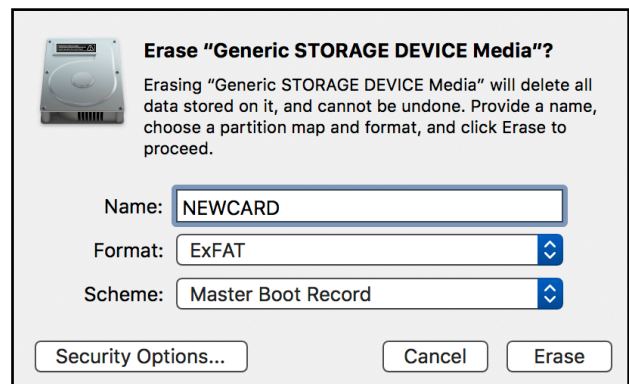
File Formats
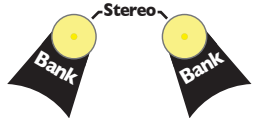
The STS recognizes the vast majority of WAV files. Verify that your files meet the following criteria (all others will be ignored):

- **Format**: WAVE
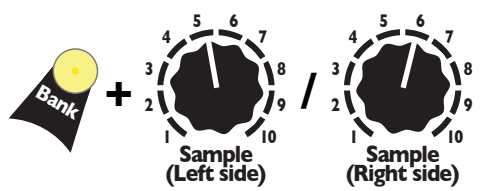- **Bit depth**: 32-bit float; 16, 24, 32-bit signed; 8-bit unsigned
- **Channels**: Stereo or Mono
- **Sampling rate**: 8kHz to 96kHz
- **File name**: Must end in .wav or .WAV
- **Folders**: files must be in a root-level folder (sub-folders are ignored)

- **Limitation on file names:** The maximum file name plus full path cannot be more than 80 characters. File names that are longer in 80 characters (including the ".wav", the folder name, plus a "/" for the separator) will be ignored.

Chart of All Button Features
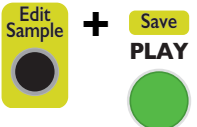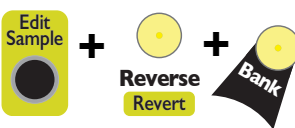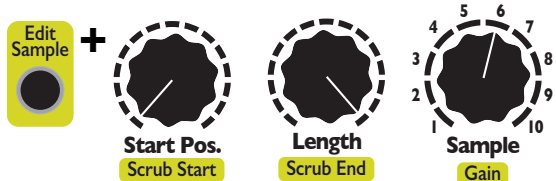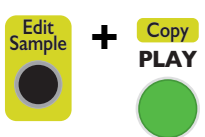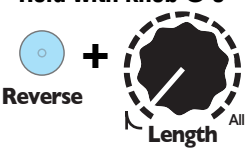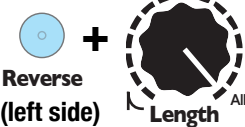
Playback:

Loop on/off
Hold 0.5 sec.
PLAY

Stereo/Mono
Hold 0.5 second
Stereo
Bank   Bank

Channel Volume
Hold…   and turn
Reverse + Start Pos.

Save Startup Bank
Hold 1 second
Edit Sample + Bank + Bank + Save PLAY

Navigating Banks:

Next Bank
Bank

Prev Bank
Reverse + Bank

Go To Any Bank
Hold…   and turn…   …and/or turn
Bank + 4 5 6 7 8 9 10 3 2 1 / 4 5 6 7 8 9 10 3 2 1
         Sample (Left side)   Sample (Right side)
         color   blink number

Go To REC Bank
Hold both 0.5 sec
Bank + Bank

Recording:

Arm Recording / Toggle Monitoring
Hold 0.5 sec
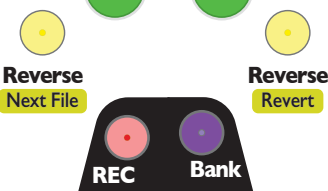REC

Editing Samples:

Save Changes
Hold both 0.5 sec
Edit Sample + Save PLAY

Undo Changes (one sample)
Hold both 0.5 sec
Edit Sample + Reverse Revert

Revert to Saved (one bank)
Hold 2 seconds
Edit Sample + Reverse Revert + Bank

Revert to Saved (everything)
Hold 4 seconds
Edit Sample + Reverse Revert + Bank + Bank

Edit Sample Loop/Trim Points and Gain
Hold…   and turn…   …and/or turn   …and/or turn
Edit Sample + Start Pos. / Scrub Start   Length / Scrub End   4 5 6 7 8 9 10 3 2 1 Sample / Gain

Copy Sample (left to right)
Hold both 0.5 sec
Edit Sample + Copy PLAY

Envelopes:

Percussive Env on/off:
Hold with knob @ 0
Reverse + Length All

Fade in/out Env on/off:
Hold w/ knob @ 100%
Reverse (left side) + Length All

System Mode
Save PLAY   Copy PLAY
Reverse / Next File   Reverse / Revert
REC   Bank

Calibration:

1V/OCT tracking:
Edit Sample + REC or Bank
-0.001V/oct   +0.001V/oct

1V/OCT offset:
Edit Sample + Bank + Bank + REC or Bank
-0.001V/oct   +0.001V/oct