ScrubBoard Operation & Design

Jump to:
ScrubBoard illustrations • Loop belt illustrations • Signal flow chart • Spec list • Return to ScrubBoard homepage

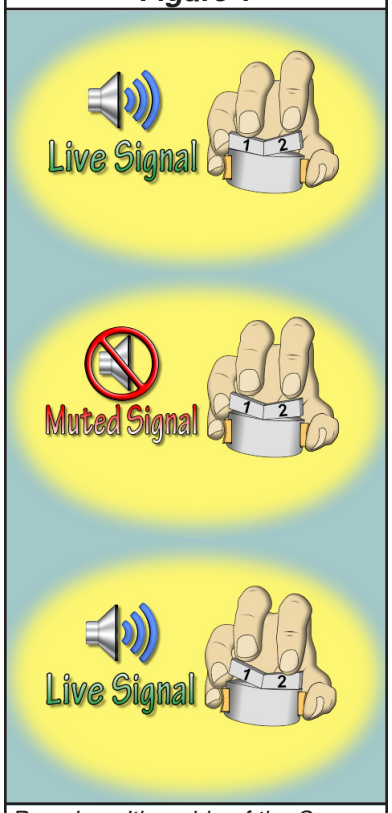
Product Concept

The ScrubBoard is meant to generate the "scratching" sound that turntable artists often use in popular music, while being a more intuitive and ergonomic alternative to the turntable. Users scratch by moving a slider up and down a track, which is visually similar to the fader controls on a standard mixing board. The slider is internally attached to a movable tape head that makes contact with a strip of audio tape inside the device. It moves up and down the tape, thus generating sound.

The Seesaw Killswitch

An important part of the turntable arts is the DJ's use of a switch or fader to rhythmically mute and un-mute the audio from the turntable. This is commonly referred to as "cutting." With the ScrubBoard, users achieve this effect by using a two-fingered push-button that sits atop the slider. I call it the Seesaw Killswitch, because pressing down on one side makes the other side come up. When either side is pressed down, the audio is un-muted. When it's in the "halfway position" (with neither side all the way down) the audio is muted. Users can open and close the audio signal by alternately pressing with their index and middle fingers, and they can grasp the slider with their other fingers, thus allowing them to cut and scratch with the same hand (see figure 1).

Figure 1



Pressing either side of the Seesaw Killswitch all the way down un-mutes the audio

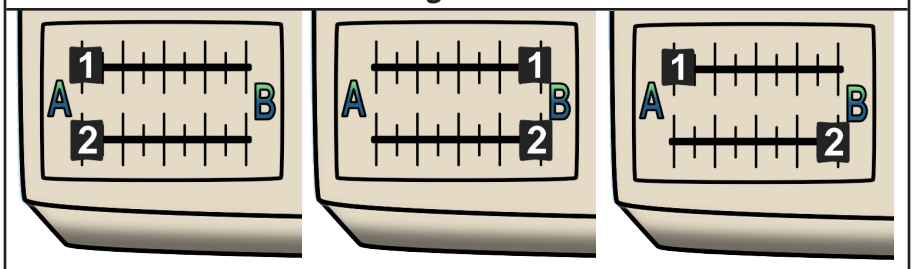
Much like a standard push-button, the Seesaw is spring-loaded so it "snaps back" to its default position when the user isn't pressing it. The halfway position is the Seesaw's default. This means that the user must be pressing down on one of its sides for the ScrubBoard to produce any sound.

While the Seesaw's halfway position always has the effect of muting the audio, the effects of pressing down the right and left sides can be customized by the user. The audio tape has four tracks, which are used here to accommodate two stereo playlists running alongside each other. The ScrubBoard uses two crossfaders so that users can "assign" one or both playlists to each side of the Seesaw. Adjust Crossfader 1 to determine which playlist you'll hear when pressing down the left side of the Seesaw. Adjust Crossfader 2 to determine which playlist you'll hear when pressing down the right side (see figure 2). The numbers "1" and "2" are printed on the left and right sides of the Seesaw, respectively, to indicate which crossfader corresponds to which side.

The Loop Belt Cartridge

Another important aspect of the turntable arts is the controlled use of the turntable motor's rotation. DJ's will periodically let go of the record and momentarily let it play at the correct speed. This is an important part of the process, because it's nearly impossible to move your hand as steadily as a motor can move. So to achieve a consistent playback speed, The ScrubBoard makes use of a motorized tape loop. But it's not the traditional kind of tape loop that you'd find in an old tape delay box -- that wouldn't be useful here because the play head needs to be able to slide up and down a long track and still stay in contact with the tape. So to make a long surface area of tape available to the play head, the tape is mounted on a loop belt with rubber rollers on either end -- like the design of a conveyor belt. The loop belt has a writable surface, so users can label all the transient audio events and then follow their movement as the loop belt turns.

Figure 2



With this crossfader configuration, pressing either side of the Seesaw Killswitch will un-mute playlist A.

With this crossfader configuration, pressing either side of the Seesaw Killswitch will un-mute playlist B.

With this crossfader configuration, pressing the left side will un-mute playlist A, and pressing the right side will un-mute playlist B.

Transport Controls

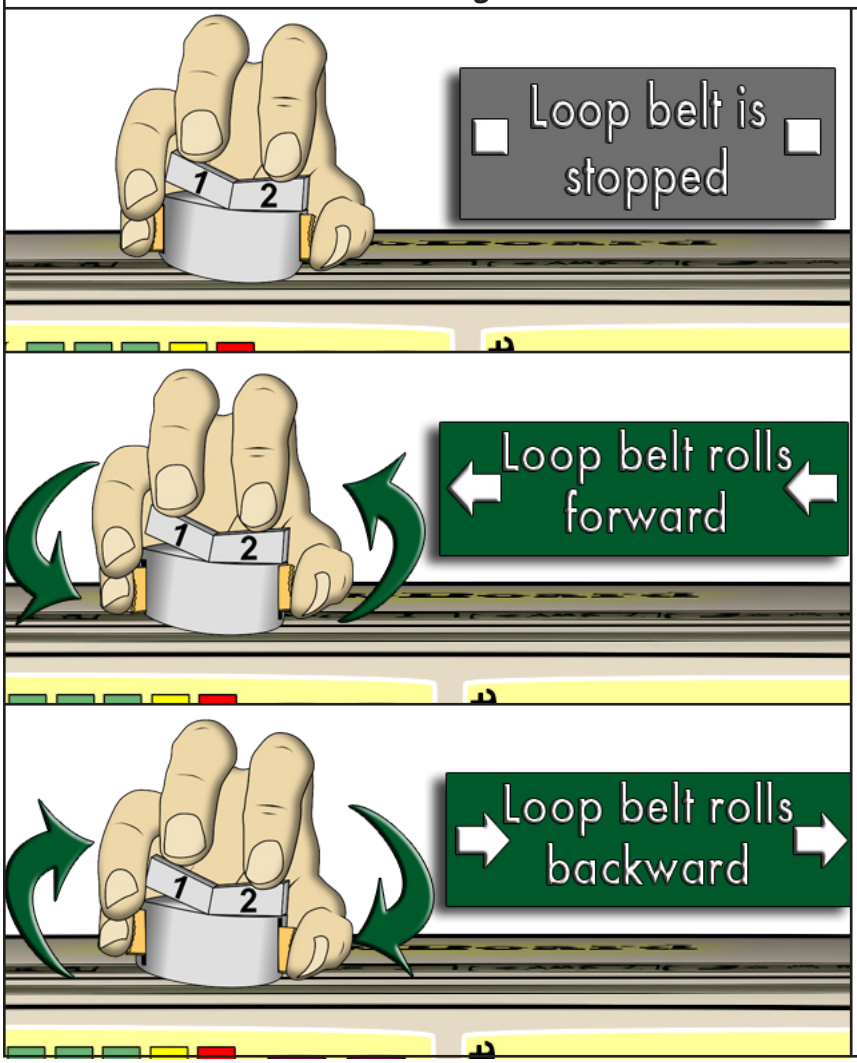
To preserve one-handed functionality, the controls for the loop belt transport are on the slider. While grasping the grips on the slider's base with their pinky, ring finger, and thumb, users can control the loop belt transport by twisting the grips (see figure 3). Twist them to the left, and the loop belt will begin rolling forward, and will continue to roll only as long as the grips are held in this position. Twist to the right and the loop belt will roll backward. The effect of twisting the grips is binary, meaning that they can only stop or start the belt's motion; they cannot adjust the belt's speed. To change the speed, users must adjust the IPS control, which is above the crossfaders.

Much like the Seesaw Killswitch, these grips will snap back to a neutral position if the user is not applying pressure to them. This means that the loop belt will only roll when the user is physically holding them in a twisted position. The one exception is that the loop belt will roll automatically when the ScrubBoard is recording.

Recording

The loop of audio tape has four tracks, and the ScrubBoard handles these four tracks as two stereo pairs, called "Playlist 1" and "Playlist 2." Users can connect line-level stereo audio sources to the ScrubBoard's RCA jacks to record to the tape loop. The "Record Enable" buttons enable users to choose to record to Playlist A, Playlist B, or both. Once the audio source is connected and one or both of the tracks are record enabled, the user presses the "Rec Start" button, and the loop belt will roll forward automatically, and the ScrubBoard will record until the "Rec Start" button is pressed again. During recording, the recorded audio will arrive at the play head (which is on the slider) a certain amount of time after it's recorded, creating a tape delay effect. The farther the slider is positioned to the left, the longer the delay will be. As the recorded audio hits the play head, users can cut and scratch with the recorded audio just as they would with pre-recorded audio, except that users won't be able to control the motion of the loop belt during the recording process.

Figure 3



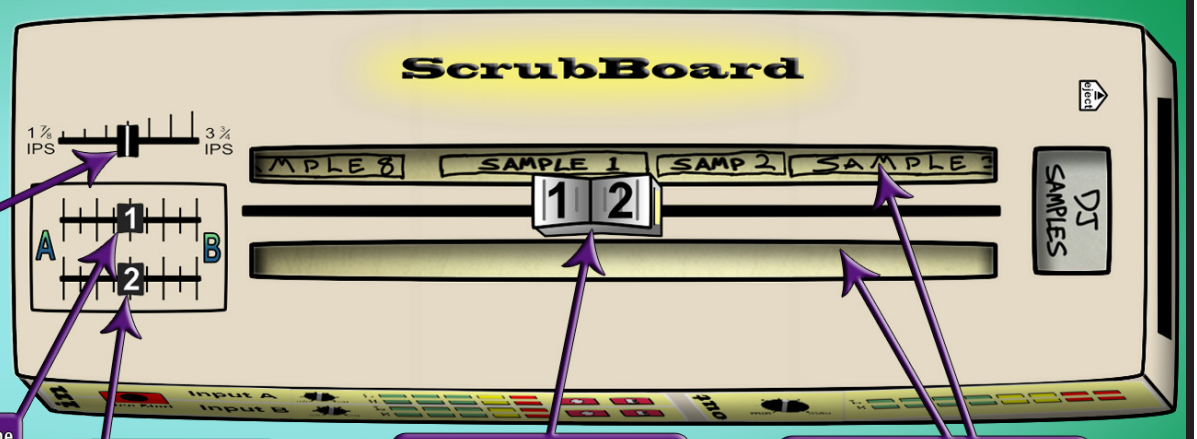
Notice how the user is interacting with the orange side grips on the slider's base. Twisting these grips to the left makes the loop belt roll forward. Twisting them right makes the loop belt roll backward.

The ScrubBoard has separate "Record Enable" and "Erase Enable" controls, so you can opt to activate both heads while recording, as in a standard tape deck, or you can instead erase the old audio first, and then record new audio. The latter option will eliminate the danger of the erase head clipping into the beginning of the newly recorded audio as it loops back to its starting point. To erase, simply press Erase Enable on one or both playlists and then press Rec Start. Separating the record and erase functions also means that if users let the ScrubBoard record for more than one cycle, they will be able to "stack" layers of sound on a single playlist. In this way, the ScrubBoard could be used to create the kinds of additive loop-based soundscapes that are sometimes found in ambient and experimental music.

Jump to:

Operation & design • Loop belt illustrations • Audio signal flow chart • Spec list • ScrubBoard homepage

Main Controls



The speed of the loop belt can be adjusted to anywhere between 1 7/8 IPS (inches per second) and 3 3/4 IPS.

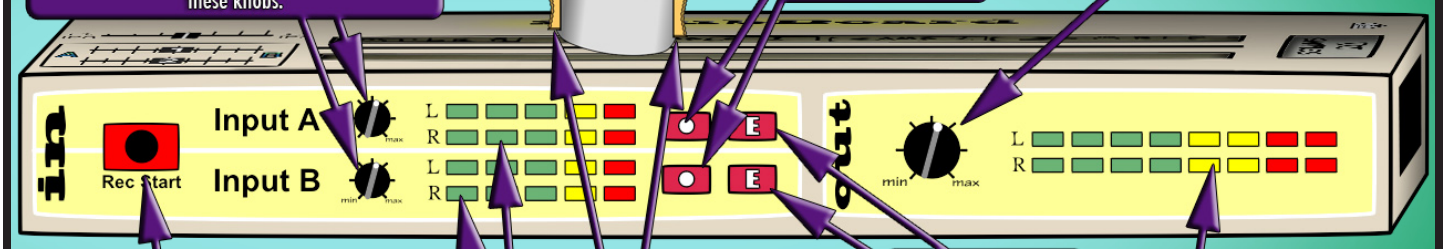
Crossfader 1 adjusts the audio that is heard when pressing "1" on the Seesaw Killswitch

Crossfader 2 adjusts the audio that is heard when pressing "2" on the Seesaw Killswitch

The "Seesaw Killswitch," a two-fingered pushbutton, is mounted on top of the tape-head slider, allowing for one-handed cutting & scratching.

The openings above & below the slider provide access to the loop belt, which has a writable surface, so you can label your samples.

Front Controls



The Seesaw Killswitch is mounted on top of the slider so you can tap the Seesaw with your index & middle fingers, while grasping the slider with your other fingers.

This is the slider. It's attached to the tape head, which makes contact with the audio tape inside the device. Moving the slider up and down the track makes the tape head move up and down the tape, thus generating audio.

Input gain knobs. The audio tape has four tracks, or two stereo tracks (side A & side B). You can record two stereo audio signals to the tape loop by connecting them to Inputs A & B, and setting the levels with these knobs.

Record enable buttons.

Output level knob.

Press this button and the loop belt will begin to roll and the ScrubBoard will record to one or both stereo tracks, depending on which tracks are record-enabled.

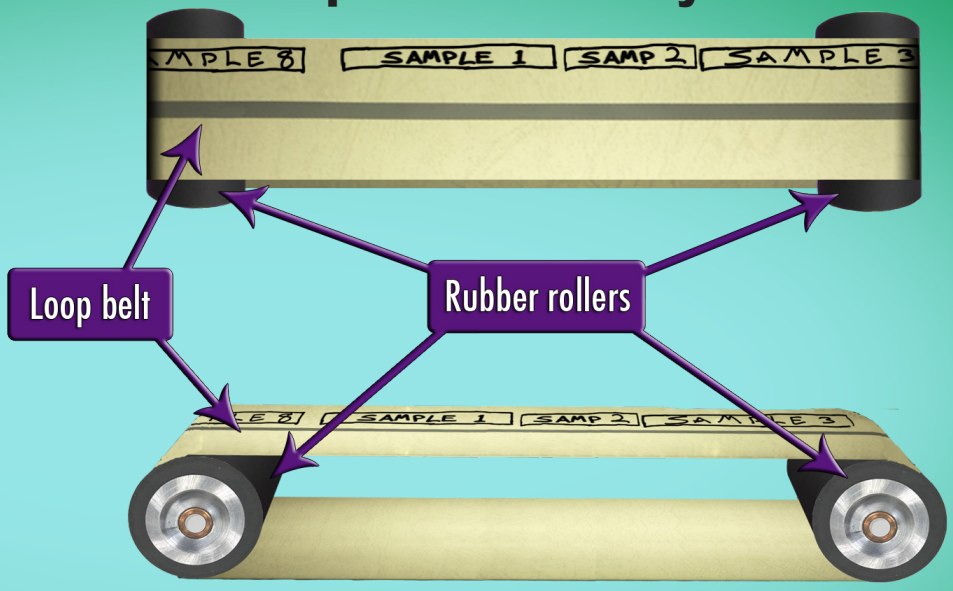
VU meters for monitoring input levels

The side grips on the slider base can be twisted left or right to make the loop belt roll forward or backward, respectively.

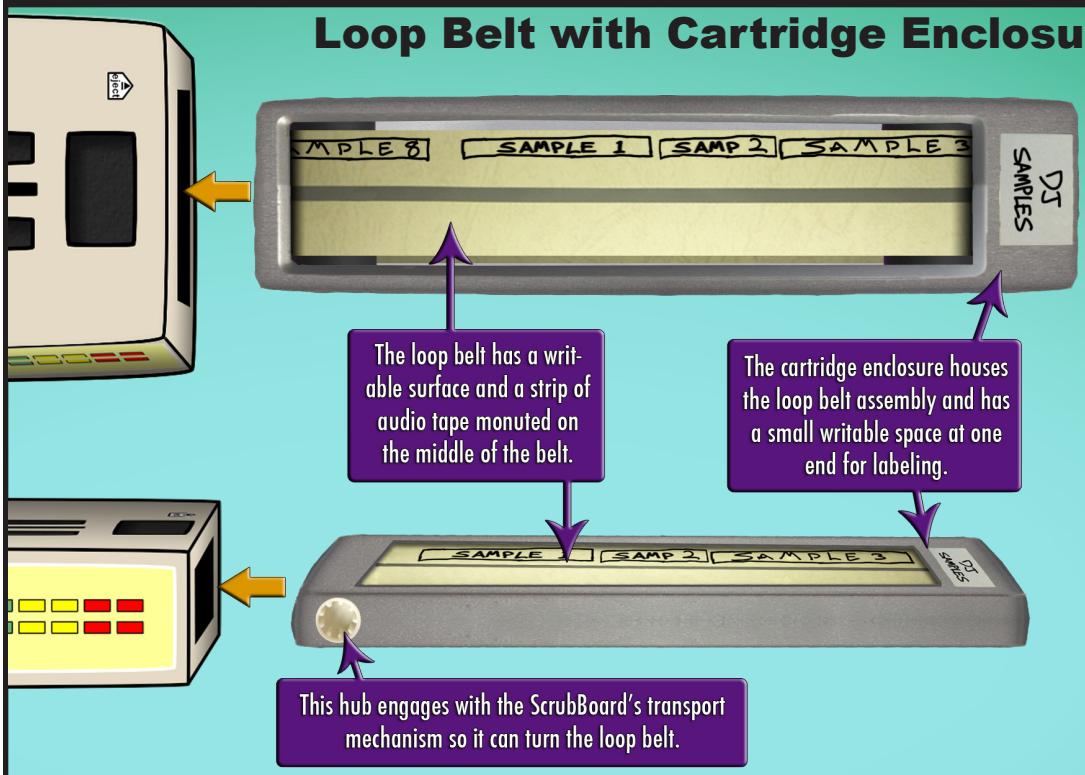
Erase enable buttons.

Output VU meter.

Loop Belt Assembly

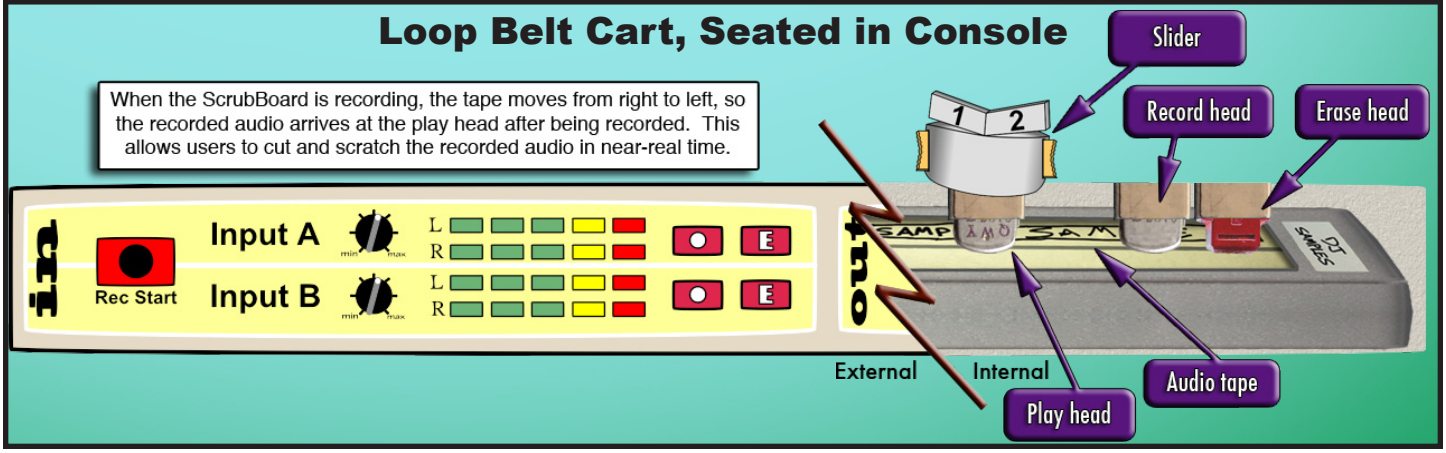


Loop Belt with Cartridge Enclosure



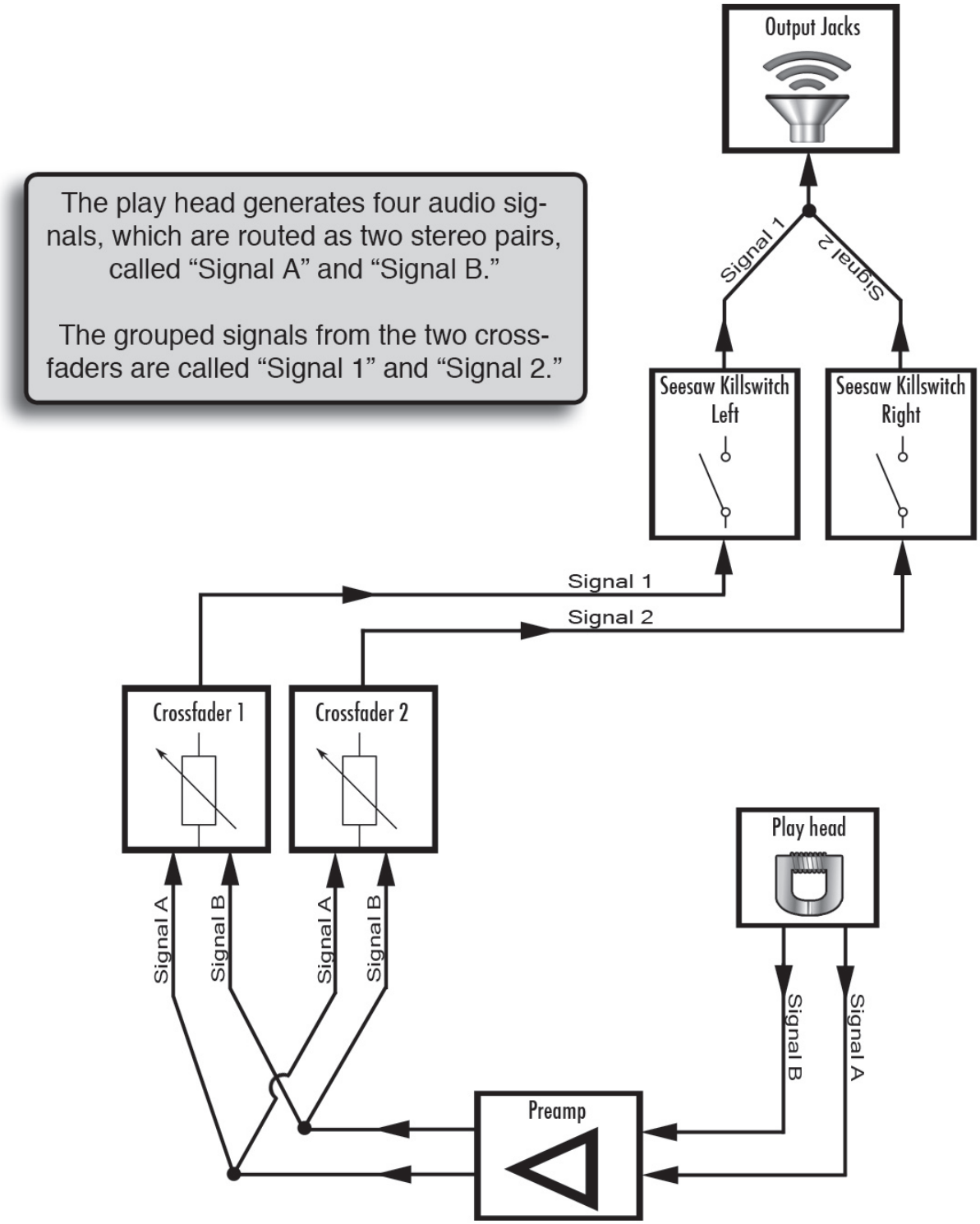
Loop Belt Cart, Seated in Console

When the ScrubBoard is recording, the tape moves from right to left, so the recorded audio arrives at the play head after being recorded. This allows users to cut and scratch the recorded audio in near-real time.



Audio Signal Flow Chart

Jump to:
Operation & design • ScrubBoard illustrations • Loop belt illustrations • Spec list • ScrubBoard homepage



The play head generates four audio signals, which are routed as two stereo pairs, called “Signal A” and “Signal B.”

The grouped signals from the two crossfaders are called “Signal 1” and “Signal 2.”

Spec List

Jump to:
Operation & design • ScrubBoard illustrations • Loop belt illustrations • Audio signal flow chart • ScrubBoard homepage

Dimensions	Approx. 30” x 8” x 3”. These dimensions can be adjusted as needed, but should be comparable to a mid-sized synthesizer keyboard, so the ScrubBoard can fit on a keyboard stand.
Main Controls	• One mechanical/electronic push-button: “Eject.” • Three slide-type potentiometers: “Tape speed control” and “Crossfaders 1 & 2.”
The Slider/ Seesaw Kill-switch	The Slider has three functions: 1) It has the purely mechanical function of allowing the user to move the tape head up and down the track. 2) On top of the Slider is the “Seesaw Killswitch,” a two-fingered push-button, whose function is to open and close the audio signals coming from the play head. 3) The side grips on the Slider base can be twisted left or right, causing the loop belt motor to run forward or backward.
Front Controls	• Five electronic push-buttons: “Record Start”, “Record Enable A,” “Record Enable B,” “Erase Enable A,” & “Erase Enable B” • Three knob-type potentiometers: “Input A Gain,” “Input B Gain,” & “Output Level” • Approx. 36 LED’s “Input VU Meter A,” “Input VU Meter B,” & “Output VU Meter”
Side Controls (not pictured)	• Six RCA jacks: “Left Input A,” “Right Input A,” “Left Input B,” “Right Input B,” “Left Output,” & “Right Output” • One 1/4 inch TRS jack: “Headphones.” • One toggle switch: “Power On/Off.”
Internal	The internal electronics will be mostly comparable to those of a standard audio tape deck. The main difference will be the electronics for the transport mechanism *(described below).* Also, the signal from the play head should be routed according to the signal flow chart on page 5. The tape heads and audio tape should be $^1/_4$ inch, as found in a reel to reel deck, but if this is not feasible, $^1/_8$ inch cassette tape is also acceptable. Either way, they must be four-track tape heads, capable of playing and recording to all four tracks at once (I believe two joined two-track heads would also work). The play head slides up and down the exposed length of audio tape on the loop belt, but the record and erase heads should be stationary on the right end of the track.
Loop Belt Cart	The loop belt assembly should be housed in a removable cartridge, if possible *(see page 4 for pictures).* However, as a cost-cutting measure, it could also be permanently built into the ScrubBoard device. Either way, it has a simple conveyor-belt design, with rubber rollers on either end. The belt itself has a writable surface (perhaps like that of a dry-erase board?) and a strip of audio tape mounted on the center of the belt. The cartridge enclosure has a wide opening so that the sliding play head can slide up and down the exposed length of tape. The cartridge also has sprockets or hubs that engage with the ScrubBoard’s transport mechanism when it is inserted into the ScrubBoard, so that the ScrubBoard can control the rotation of the rollers, and consequently, make the loop belt move. If the ScrubBoard is 30 inches wide, it should be able to accommodate a loop belt cart that is about 25 inches wide. This allows for roughly 50 inches of tape (since the tape is doubled over in a loop), so the cart can contain around 27 seconds of audio at the slowest tape speed (1 $^7/_8$ inches per second).