loop

by jroo

loop is a frippertronics-style stereo digital tape loop, echo and delay module with adjustable tape speed, play head position, feedback and audio levels. It has a customizable loop length of up to 2.5 minutes.

Contents

Overview

Knobs

in - level of audio input

speed - speed and direction of tape (for both recording and playback)

feedback - amount of playback signal sent back to incoming audio

dry/wet - mix between incoming signal and playback from tape

playhead - distance between record head and play head

Lights

green solid - play indicator

green blink - on loop start

red - record indicator

alternating slowly - ready for initialization

alternating quickly - erase warning

Switch

record - used for toggling recording and erasing the loop

Jacks (-5V to 5V)

record - gate to toggle recording

speed - CV to control tape speed and direction

feedback - CV to control feedback level

dry/wet - CV to control dry/wet mix

in 1, in 2 - dual mono inputs

out 1, out 2 - dual mono outputs

loop is modeled after tape loop systems where audio is recorded to and played back from a tape that's continually looping. Several interesting effects can be accomplished in a system like this when the position of the play head, tape speed, direction, and audio and feedback levels are modified. *loop* gives you manual and CV control over each of these.

Frippertronics is a practice pioneered by guitarist Robert Frip utilizing a tape loop strung between two analog tape machines, one to record the signal and the other to play it back. This module acts as both.

loop's signal flow mimics that of a traditional tape loop system. As tape passes by the position of the record head, the existing audio on the tape is erased and an incoming audio signal is recorded in its place. The audio that is recorded to tape is played back at

the position of the play head. The audio signal from the play head can be mixed with the incoming signal for output, or fed back and mixed with the incoming audio to be recorded again.

The following sections will walk you through some of these effects and provide details on *loop's* controls.
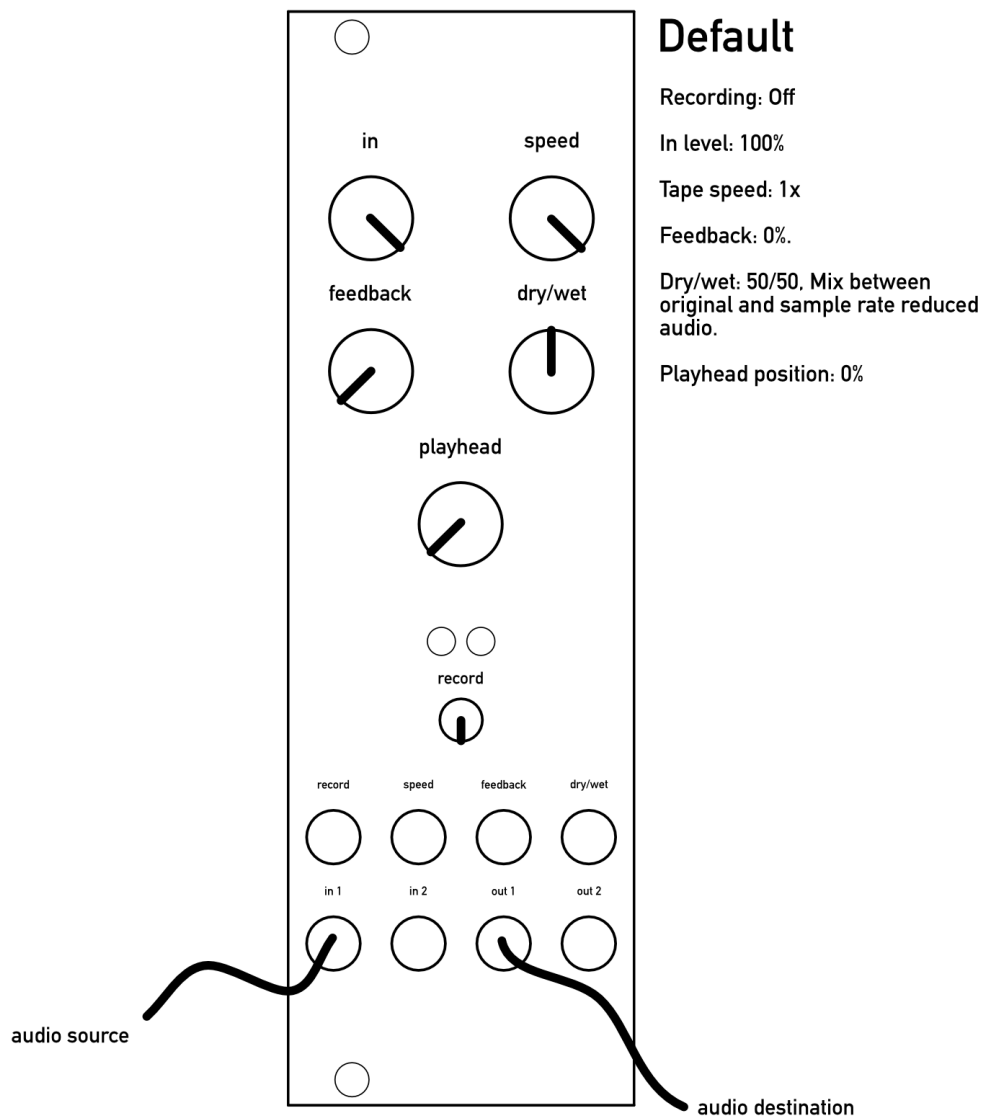
traditional tape loop system
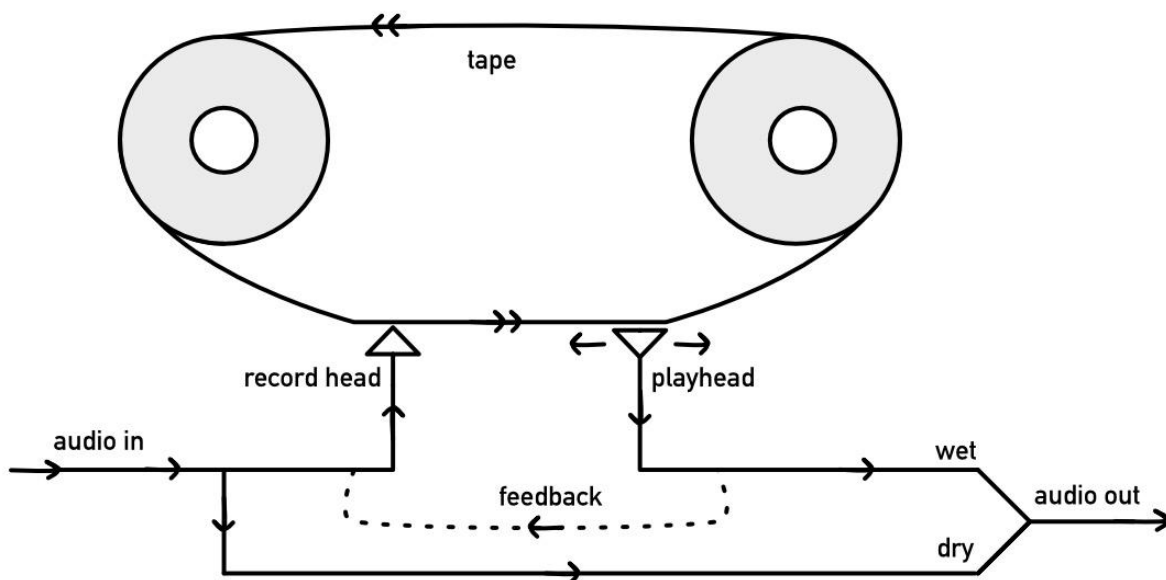
Getting started

To follow along with the examples below put your *loop* in the following configuration. We'll call this the "default configuration".

- set the audio input level to full by turning the in knob *fully clockwise*
- set the tape speed to 1x by turning the speed knob *fully clockwise*
- set the feedback level to zero by turning the feedback knob *fully counterclockwise*

- set the dry/wet mix to 50% by turning the knob to a *12:00 position*, pointing straight up
- put the play head and the record head in the same position by turning the playhead knob *fully counterclockwise*
- set the record switch to *off (down)*
- patch an audio source into the in 1 jack
- patch your audio out through the out 1 jack.

in   speed

feedback   dry/wet

playhead

record

record   speed   feedback   dry/wet

in 1   in 2   out 1   out 2

audio source

audio destination

Default

Recording: Off

In level: 100%

Tape speed: 1x

Feedback: 0%.

Dry/wet: 50/50, Mix between original and sample rate reduced audio.

Playhead position: 0%

Set the loop length with the initial recording

When you first power on *loop*, the green and red lights will be alternating slowly. This means that the module is ready to record the initial loop. Start by flipping the record switch *on (flipped up)* and then, after five or six seconds, switching it *off (flipped down)* again.

While you were recording, both lights turned to solid. Solid red means audio is recording to tape and solid green means the tape is playing. When you flipped the record switch to *off (down),* the recording stopped and the red light turned off because it was no longer recording.

The length of this first recording determines how long your tape loop is. During playback, when the end of the loop is reached, it will immediately start again at the beginning and continue looping until you stop playback or erase the loop. The length of this loop will not change until you erase the loop.

You should now see a solid green light that quickly blinks every five or six seconds (the length of your loop) and hear the audio that you recorded repeating on a loop. The quick blink happens every time the loop starts over and the "start" of the loop passes through the record head.

Change the dry/wet mix

Your dry/wet mix is currently set at 50% so you will hear both the incoming audio and the tape loop being played at equal volumes. To hear just the incoming audio, turn the dry/wet knob *fully counterclockwise* for a 100% dry (original, unprocessed) signal. To hear just what's recorded to tape, turn it *fully clockwise* for a 100% wet (processed) signal. Keep it *fully clockwise* for now and listen to what's on the tape as it loops.

Control the tape speed

Now that your loop is playing, change the tape speed with the speed knob. *Fully clockwise* is 1x speed. Slowly turn it until it reaches *the 12:00 position (pointing straight up).* The playback will slow down, then stop and the green light will turn off. You're now at 0x speed and the tape isn't playing. Continue turning counterclockwise and the tape speed will slowly speed up again but in reverse. *Fully counterclockwise* is -1x speed, or 1x speed in reverse. Play with different speed settings for a while. Notice that as the speed changes, the pitch also shifts. When you're ready, bring the speed knob back *fully clockwise* to play at 1x speed.

Change the play head position

In traditional tape loop systems there are two "heads", one that records audio to a tape and another that picks audio up off the tape and plays it back. The *loop* module follows the same principle. Audio is recorded to one part of the loop at the record head position and audio is played back from another, the play head position. The playhead knob determines how far apart record and play heads are. This controls how much delay exists from when something is recorded and when it is played back.

The default position for the playhead knob is *fully counterclockwise.* Here, the play head and the record head are in the exact same spot. This means that as soon as something records, it immediately plays back. As you turn the knob clockwise, the play head moves further behind the record head and increases the delay.

Turn the playhead knob *fully counterclockwise* and flip the record switch *up* to begin recording. Because the record head and play head are in the same position, you should hear the audio that you have patched in with no delay. What you're actually hearing is the immediate playback of what's recorded on the tape. Turn the dry/wet knob to dry so you're listening to the dry input. Now set it to wet and notice that the audio is the

same. That's because what's being recorded to tape is immediately being played back so it just sounds like live audio.

Now let's play with the play head. Go ahead and stop recording for now (flip the switch *down*), make the dry/wet mix 50% (dry/wet knob at *12:00, pointing up*) and set the playhead knob to *12:00, pointing up*. Start recording again. You'll now hear your input playing back again but this time with a delay. Setting the knob to *12:00* makes the playback distance equal to half your loop length so the delay is half the time of your total loop. If your loop is six seconds the delay will be three seconds.

Play with playhead positions to set different delay times. When you find a delay interval that you're happy with, set the dry/wet knob to various positions to change the volume of the live audio vs. the delayed audio.

Add feedback

It's possible to take the audio that's being played from the tape and send it back to the record head so it's recorded again, creating a feedback loop. Turning the feedback knob *clockwise* increases the level of the audio that's sent back to the record head. While you're still playing back the delay that you previously set, slowly increase the feedback level and notice that the delay now repeats multiple times instead of just once and it fades out over time. The more you increase the feedback level, the more times you hear the repeated signal and the longer it takes to fade out. Turning the feedback knob *fully clockwise* will result in the repeated signal never fading out and accumulating more and more audio every loop. This can get crazy quickly! Especially if the playhead and record head positions are close to each other. To tame the feedback, turn the feedback knob back down (*counterclockwise*).

Erase the loop

To erase and reinitialize the tape, stop recording (record switch flipped *down*), set the tape speed to zero (speed at *12:00*) then flip the recording switch on, then off, three times. While flipping, the record and play lights will flash quickly to let you know that you're about to initialize the loop. To abort the initialization before flipping on and off three times, stop flipping and wait two seconds. Once the loop is initialized, the tape is erased and you can record another loop and set a new length.

Bring it all together

Now that you have a handle on recording, the dry/wet mix, tape speed, play head position and feedback, play around with different combinations of each and see what you can come up with. Once you feel like you have a handle on the manual controls, bring CV in to toggle the record, speed, feedback and dry/wet settings. More patch ideas can be found later in this document.
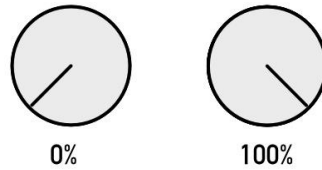
Detailed functionality

Knobs

In

The in knob determines how much of the incoming (dry) audio signal is passed to *loop.* Fully *clockwise* is 100%, full volume. Fully *counterclockwise* is 0% and no audio is passed in.

in

0%   100%

Speed

The speed knob sets the speed of the tape. The speed of the tape determines the speed at which the tape moves relative to the record and playheads. If speed is set to 1x when recording then set to 0.5x on playback, what's played back will sound twice as slow and at a lower pitch. Alternatively, speed is set to 0.5x when recording and then set to 1x at playback, it will move twice as fast and play at a higher pitch.
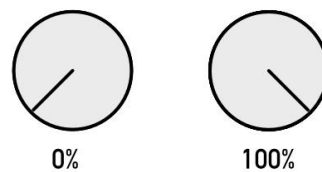
speed

-1x   0x   1x
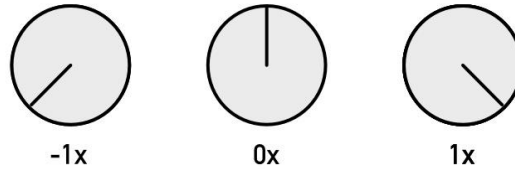
Feedback

The feedback knob determines how much of the signal that's played back from tape is sent back to be mixed with input to be recorded again.
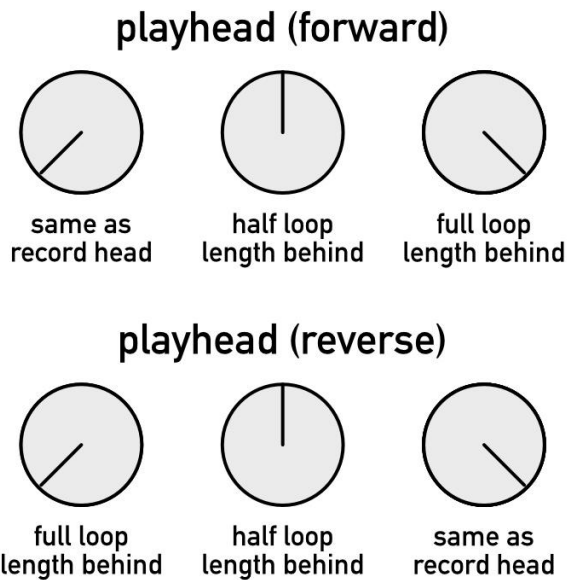
feedback

0%   100%

Dry/wet

The dry/wet knob sets the mix between the incoming audio (dry) signal and what's played from tape. Fully *counterclockwise* is fully dry and only the incoming audio signal is output. Fully *clockwise* is fully wet and only what's played from tape is output. A *12:00 position (straight up)* sets an equal mix of dry and wet, meaning the incoming audio and tape playback are output at equal levels.
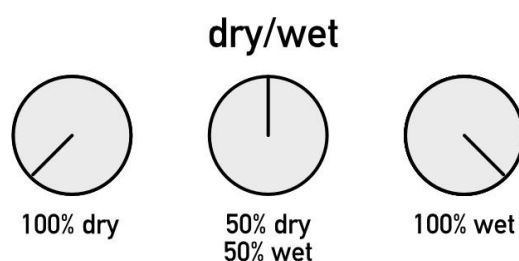
Playhead

The playhead knob sets the position of the play head relative to the position of the record head (or the *distance* between the record head and the playhead). This determines how much time there is between when a signal is recorded to tape and when it is played back. The knob sets the value relative to the length of the loop. If the tape is moving forward (the tape speed is positive), fully *counterclockwise* will set the playhead in the same position as the record head meaning audio will be played back as soon as it is recorded. At a *12:00 position (straight up)*, the play head is half a loop behind the record head. For example, if a loop length is six seconds and the tape is being played at 1x speed, the playhead will play back an incoming signal 3 seconds after it is recorded. Fully *clockwise* is a full loop length behind. **Note: playback time will be different depending on which direction the tape is moving.**To understand this, look at the "traditional tape loop system" graphic near the beginning of this documentation. In this case, if the tape is moving forward, it will play back relatively soon then loop all the

way around to the record head again. If the tape is moving in the opposite direction, it will loop all the way around *first,* before playing back, resulting in a longer delay.

playhead (forward)

same as record head	half loop length behind	full loop length behind

playhead (reverse)

full loop length behind	half loop length behind	same as record head

Lights

loop has two lights to indicate the status of the module: green and red.

Alternating slowly - *loop* is in the initialization state and is ready for its first recording
Alternating quickly - erase warning: a loop erase/initialization is being initiated
Solid red - incoming audio (and feedback) are being recorded to tape at the record head position
Solid green - audio is being played back from the play head position
Green blink - when playing, the green light will quickly blink off then on again each time the tape loops. If a loop length is six seconds, it will blink once every six seconds.

Record Switch

The record switch is used to toggle recording audio to tape on and off. *Up* is *on* and *down* is *off.* The record switch is also used when erasing and initializing the loop (see "Erasing the loop" below). **Note: the minimum length for an initial recording is 0.2 seconds, even if the initial recording is disabled before 0.2 seconds has passed. There is no minimum for other recordings, just an initial recording.**

Jacks

Record
Type: Gate
Range: 0V low, > 0.7V high

The record jack is a gate in that toggles recording. The gate is *off* at 0V and it is *on* at anything above 0.7V. The record jack and record switch have an OR relationship, meaning that if either is on, a record command will be sent to the *loop.*

Record Switch	Record Gate	Recording
Off	*Off*	*No*
Off	*On*	*Yes*
On	*Off*	*Yes*
On	*On*	*Yes*

Speed
Type: CV
Range: -5V to 5V

The control voltage input at the speed jack is combined with the speed knob to control the tape's speed. A control voltage of 5V adds 1x to the speed set by the speed knob, a

voltage of -5V subtracts 1x (or adds -1x) to the speed and 0V does not influence the speed set by the knob.

Speed Knob	Speed CV	Tape Speed
1x	0V	1x
1x	5V	2x
1x	-5V	0x
0x	0V	0x
0x	5V	1x
0x	-5V	-1x
-1x	0V	-1x
-1x	5V	0x
-1x	-5V	-2x

Feedback
Type: CV
Range: -5V to 5V

Control voltage sent through the feedback jack is combined with the feedback knob to control the feedback level. 5V adds 100% to the feedback value set by the knob, -5V subtracts 100% and 0V keeps the value unchanged. *The feedback level is bound to a range of 0% to 100% even if the combination of feedback CV and the knob value go outside of this range.*

Dry/wet
Type: CV
Range: -5V to 5V

Control voltage sent through the dry/wet jack is combined with the dry/wet knob to control the dry/wet mix.* Positive voltage makes the mix more wet and negative voltage makes the mix more dry. +5V is the equivalent of a half knob turn *clockwise* and -5V is the equivalent of a half knob turn *counterclockwise.*

In the [alt-reset firmware](#), the dry/wet jack instead triggers the tape position to reset. Voltage above 2.5V will trigger the reset.

In 1 and In 2
Type: Audio
Dual-mono audio inputs. AC-coupled.

Out 1 and Out 2
Type: Audio
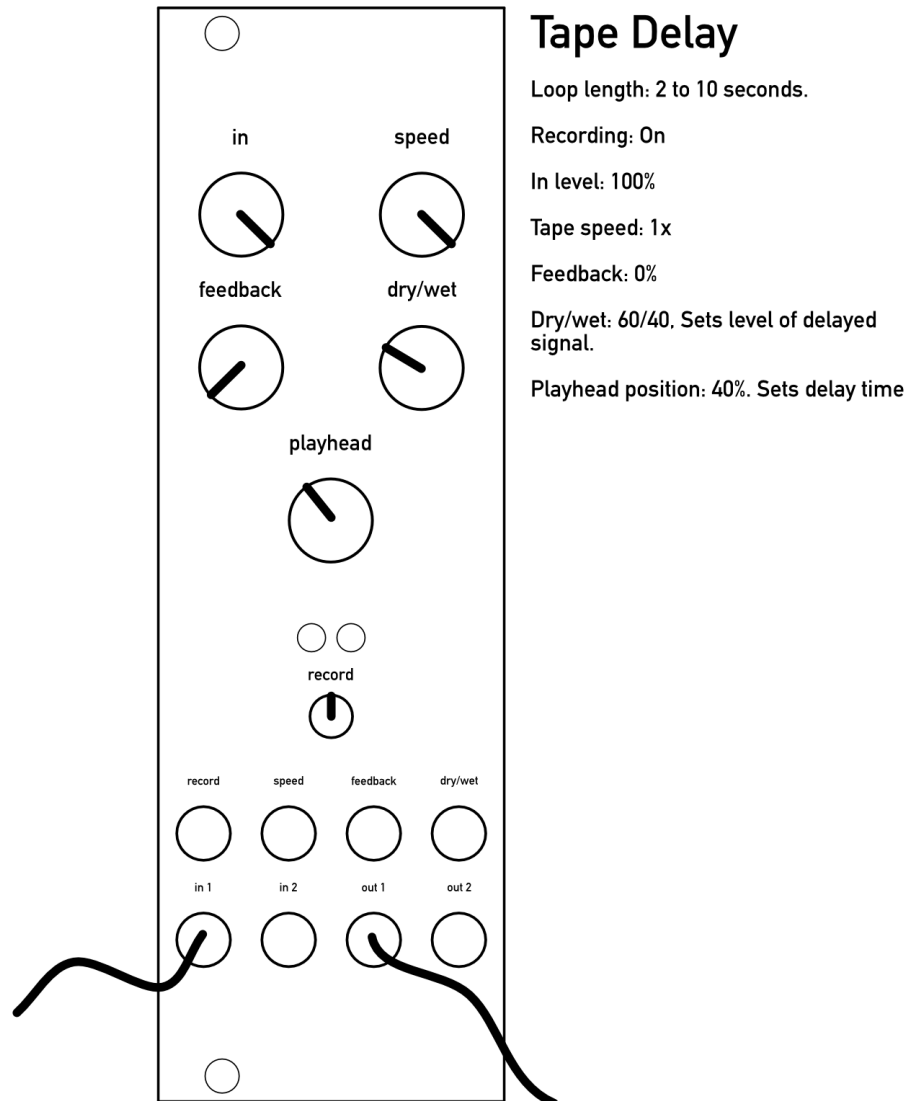Dual-mono audio outputs. DC-coupled. 48kHz / 24-bit.
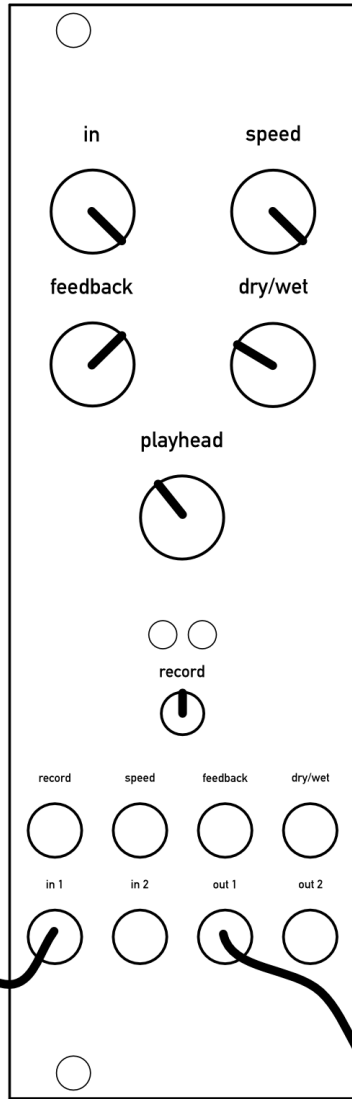
Erasing the loop

The tape loop can be erased and put in the initial state it was in when the *loop* module initially started. This can be useful if you want to erase the audio on the tape and/or create a new loop length. To erase and initialize, the speed of the tape must be set to zero. With the tape speed at zero, flip the record switch up and down three times. While flipping up and down the green and red lights will *alternate quickly*, indicating that an initialization is being initiated. After the switch is flipped up and down three times, the loop will be erased and initialized and the green and red lights will *alternate slowly*, indicating that the module is once again ready for an initial recording.

Aborting an initialization

If an initialization has been initiated but isn't complete yet, it can be aborted by no longer flipping up and down and waiting two seconds. When the green and red lights stop *alternating quickly*, the initialization has been aborted.

Patch ideas

Tape Delay

Loop length: 2 to 10 seconds.

Recording: On

In level: 100%

Tape speed: 1x

Feedback: 0%

Dry/wet: 60/40, Sets level of delayed signal.

Playhead position: 40%. Sets delay time

Echo

Loop length: 2 to 10 seconds.

Recording: On

In level: 100%

Tape speed: 1x

Feedback: 60%. Sets echo decay rate.

Dry/wet: 60/40. Mix between incoming signal and echoes.

Playhead position: 40%. Sets time between echoes.

in

speed

feedback

dry/wet

playhead

record

record

speed

feedback

dry/wet

in 1

in 2

out 1

out 2

audio source

audio destination

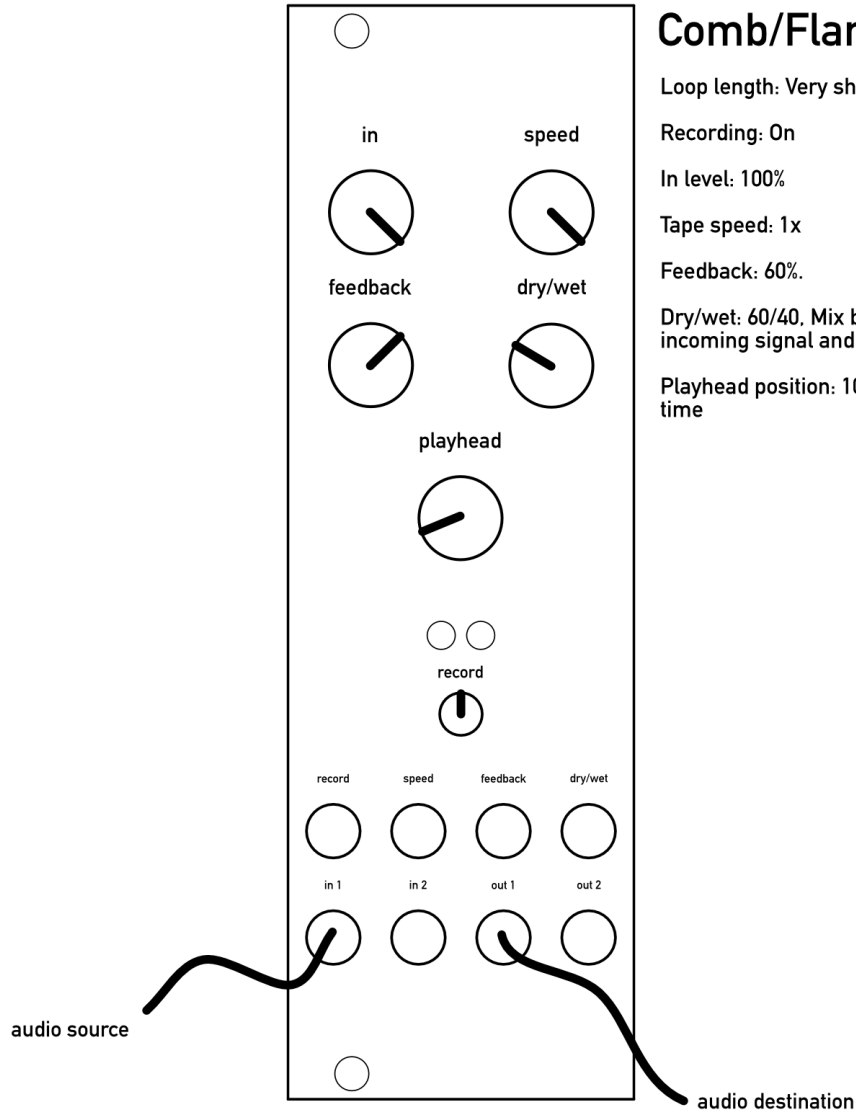# Comb/Flanger

Loop length: Very short (0.1 - 0.2s)

Recording: On

In level: 100%
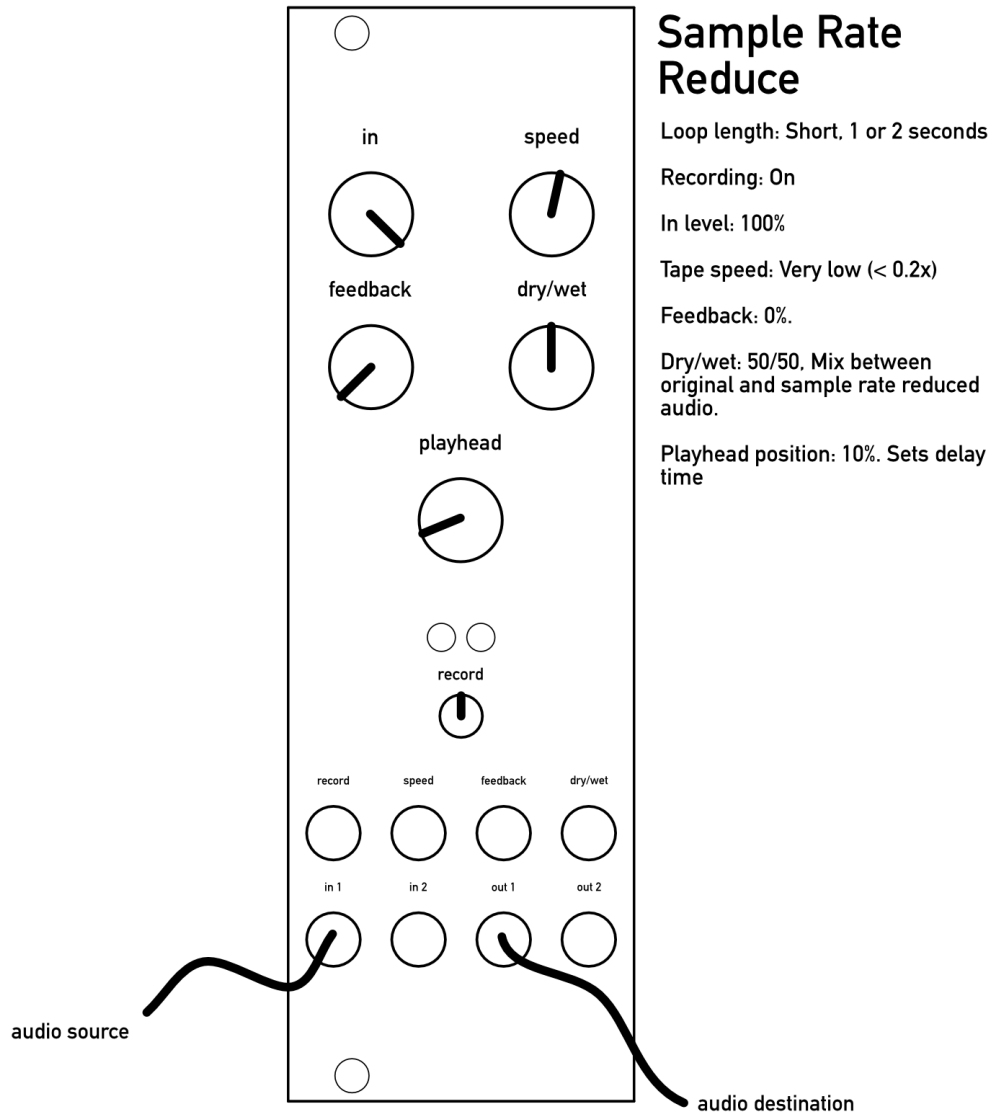
Tape speed: 1x

Feedback: 60%.

Dry/wet: 60/40, Mix between incoming signal and echoes.

Playhead position: 10%. Sets delay time

in

speed

feedback

dry/wet

playhead

record

| record | speed | feedback | dry/wet |

| in 1 | in 2 | out 1 | out 2 |

audio source

audio destination

Sample Rate Reduce

Loop length: Short, 1 or 2 seconds

Recording: On

In level: 100%

Tape speed: Very low (< 0.2x)

Feedback: 0%.

Dry/wet: 50/50, Mix between original and sample rate reduced audio.

Playhead position: 10%. Sets delay time

in

speed

feedback

dry/wet

playhead

record

record   speed   feedback   dry/wet

in 1   in 2   out 1   out 2

audio source

audio destination

- Quantized loop: use a gate with the length of a bar or two to create your initial recording. This will allow you to more easily find time musically relevant time divisions for delays on the knob or keep the loop more in sync with a clocked patch. Note that if left looping, there will still be drift over time as clocks on different devices aren't perfectly aligned. An alternate firmware called *alt-reset* is available that repurposes the dry/wet cv in as a trigger to reset the tape position, allowing you to stay in sync with a clock.

- Use an envelope follower to send a trigger once per loop. loop does not have CV or gate out but you can send a trigger once per loop with the help of an envelope follower. If you have an unused audio channel, record a blip to it. Send that channel to an envelope follower to trigger a gate everytime the blip plays. You now have a trigger once per loop. Send that trigger to a clock divider/multiplier to generate more divisions of your loop length and keep your system in sync with your loop length.

- Bring your own wow and flutter with speed CV.

- Quantized playback - Tape speed also determines pitch. As playback slows down, the pitch lowers and as it speeds up, the pitch rises. The following control voltages set the speed to pitches in semitones relative to your incoming signal, allowing for harmonization between the incoming audio and what's played off of tape. The voltage changes that you send depend on whether the tape is playing forward (1x) or reverse (-1x).

  Record a loop to tape and mix it with incoming audio. Set the speed to 1x and use the following table to change the tape speed with control voltage. Drop what's being played an octave by sending -2.5V to the speed CV. Now move it up an octave by sending +5V to the speed CV. Keep it in harmony by pitching it up a perfect fifth (7 semitones).

Change (semitones)	Voltage change if forward (1x)	Voltage change if reverse (-1x)
-12	-2.500	2.500
-11	-2.351	2.351
-10	-2.194	2.194

-9	-2.027	2.027
-8	-1.850	1.850
-7	-1.663	1.663
-6	-1.464	1.464
-5	-1.254	1.254
-4	-1.031	1.031
-3	-0.796	0.796
-2	-0.546	0.546
-1	-0.281	0.281
0	0.000	0.000
1	0.297	-0.297
2	0.612	-0.612
3	0.946	-0.946
4	1.300	-1.300
5	1.674	-1.674
6	2.071	-2.071
7	2.492	-2.492
8	2.937	-2.937
9	3.409	-3.409
10	3.909	-3.909
11	4.439	-4.439
12	5.000	-5.000

Alternate firmware

alt-reset

An alternate firmware called alt-reset is available that repurposes the dry/wet CV input as a trigger input to immediately start the loop over by resetting the "start" of the tape back to the position of the record head. This allows you to stay in sync with an external clock. Using the playhead control, you're able to define where in the loop playback is started when reset is triggered. Add speed adjustment and you're able to create granular loops of any size starting at any position in the loop.

Firmware updates & support

yo@jroo.co
https://jroo.co/products/loop/firmware

Acknowledgements

Special thanks to Sarah, Nick Brethauer, M.Christian, Christopher H. M. Jacques, Mike Jett, Mike Gintz (Mute City), Fayek Helmi (256k), Ben Rosenbach (benirose), Alex (3hands4milo), Dom at Cicada Sound, Gabriel, Manu, Ottawa Experimental Music Discord, Earth Modular Society, EZBOT, lines, Teletype Study Group and the Europi and Winterbloom communities for your support, encouragement and inspiration. No way this happens without all of you.

Designed and assembled in Canada

▦ jroo music machines

Documentation version: 20230312