Lag Processor

Audio Signal Modification Unit
User Manual And Technical Reference

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I wish you the greatest success in your research

James Chaffinch

James Chaffinch, CEO

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 Document version 1.01

Contents

Description

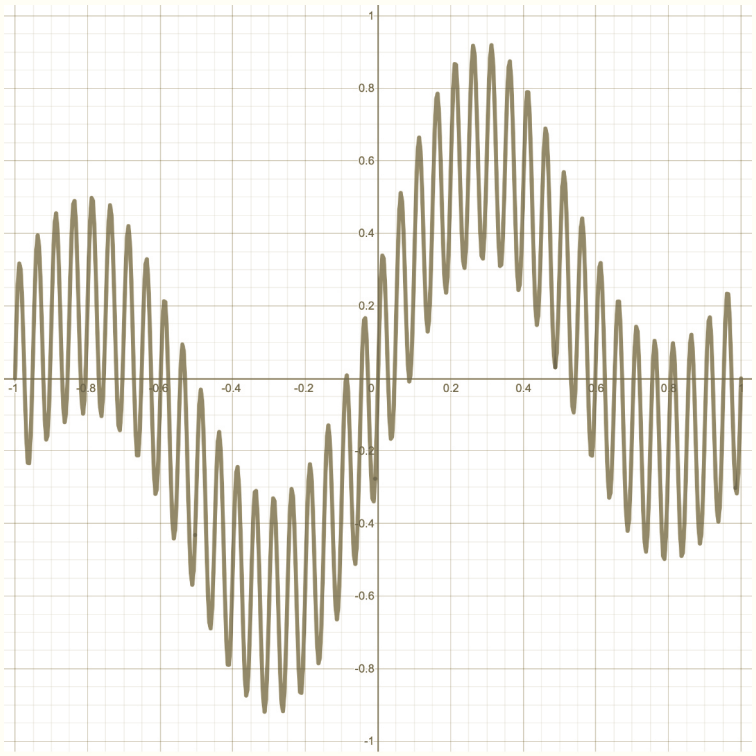
The Lag Processor unit is an audio signal modification device which implements a simple averaging computation over a series of received values - or samples - producing this averaged value as the audio signal output.

As samples are received by the input connection, they are placed in an internal digital storage unit. The number of samples stored is defined as the “Samples To Average” value, which can be defined externally, between 1 and 100. For every new sample that is received, the oldest value in the memory is removed, resulting in the memory always containing the most recently received samples. In addition, after this sample is added to the memory; the system will produce an output sample generated by summing all the samples in the memory, then dividing that summation value by the number of samples in the memory.

The resulting effect is to reduce the efficacy of high-frequency or rarely occurring values. Adjusting the “Samples To Average” value causes this filtering effect to become more or less powerful, as it spans more or less values in time.

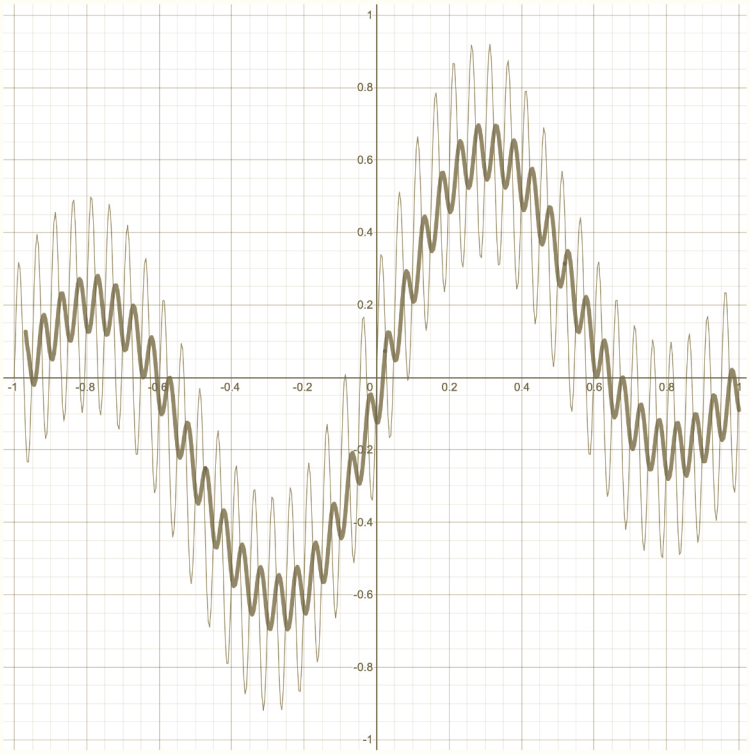
An Example

Below we can see a waveform made of two notable waveforms added together; one of low frequency and one of high frequency. Using the Lag Processor, it is possible to extract the low frequency wave.

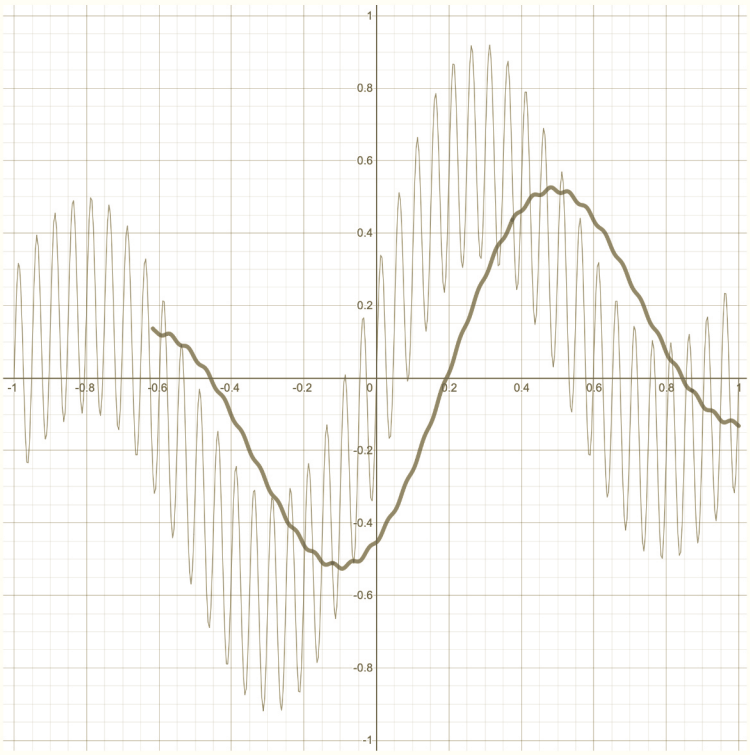


Original Waveform

By adjusting the number of samples that are averaged, we are able to remove the high-frequency waveform. Note how the averaging process adds an amount of delay to the signal, proportional to the number of samples to be averaged.



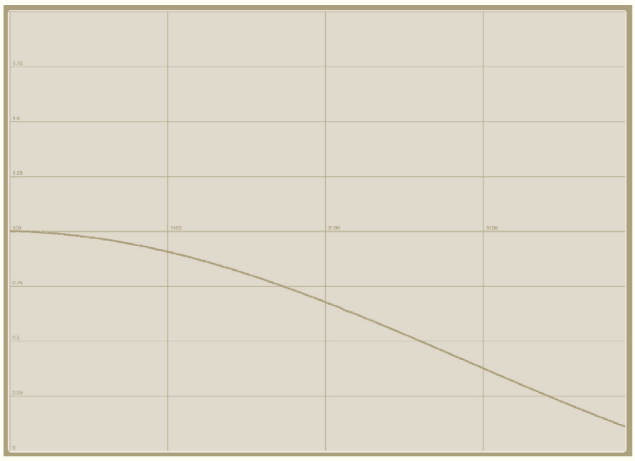
Samples To Average: 10



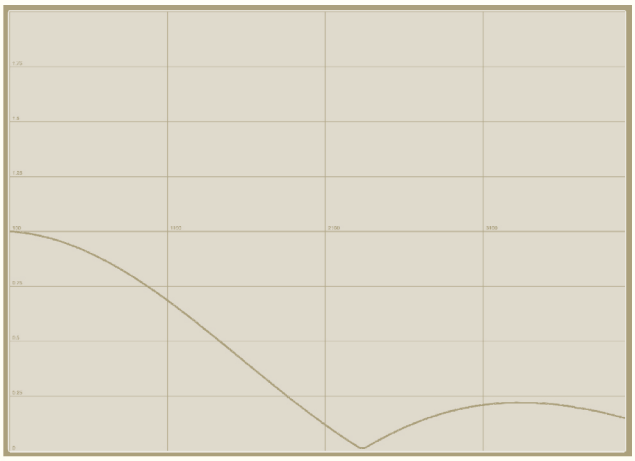
Samples To Average: 100

The Bouncing Artifact

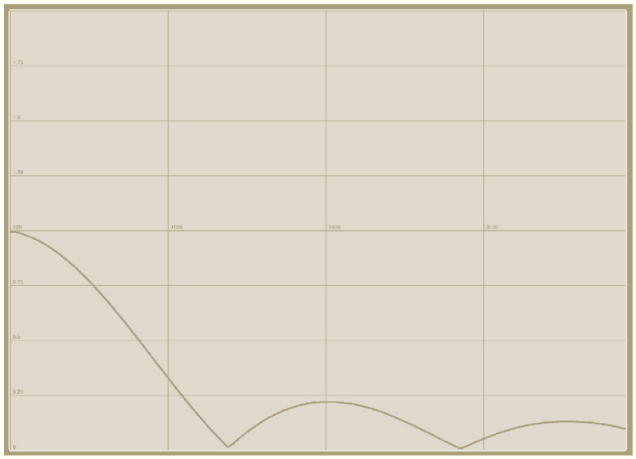
Unlike a typical low-pass filter, the Lag Processor produces a distinct “bouncing ball” frequency response. Below we can see that effect over a range of 1000hz to 4000hz. The low points on these graphs are the harmonic frequencies of the Lag Processor for these settings of the “Samples To Average”.



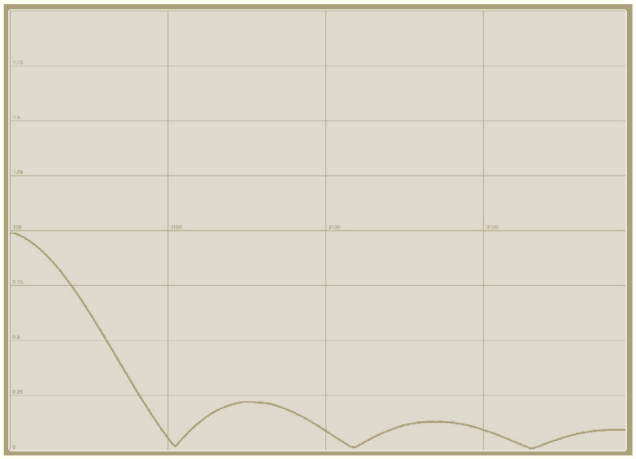
Samples To Average: 10



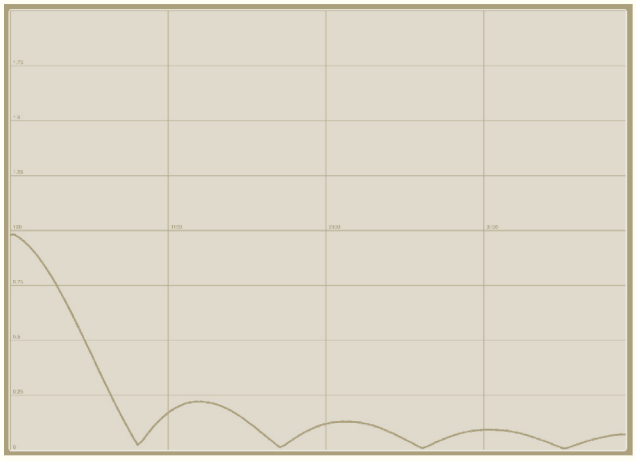
Samples To Average: 20



Samples To Average: 30



Samples To Average: 40



Samples To Average: 50

The effect is produced when the frequency of the waveform, aligns with both the number of samples which are being averaged, and the duration between when samples are taken.

In other words, when the incoming frequency is a rate at which one complete wave of this waveform takes up the same number of samples as are being averaged by the Lag Processor, the result will be zero. This continues for whole multiples of that frequency.

We can calculate the frequencies that these zero-points are reached with a simple formula. We first know that the device has a sample rate of 44100 samples a second. Dividing this by the number of samples the device is averaging returns the frequency of the primary zero-point.

For example, when averaging 10 samples; 44100 / 10 = 4410hz. Subsequent zero-points are whole multiples of this value; 8820hz, 13230hz, 17640hz, etc.

Interface

1. Audio Signal Input
   The audio signal input connection

   CUIS type: Orange

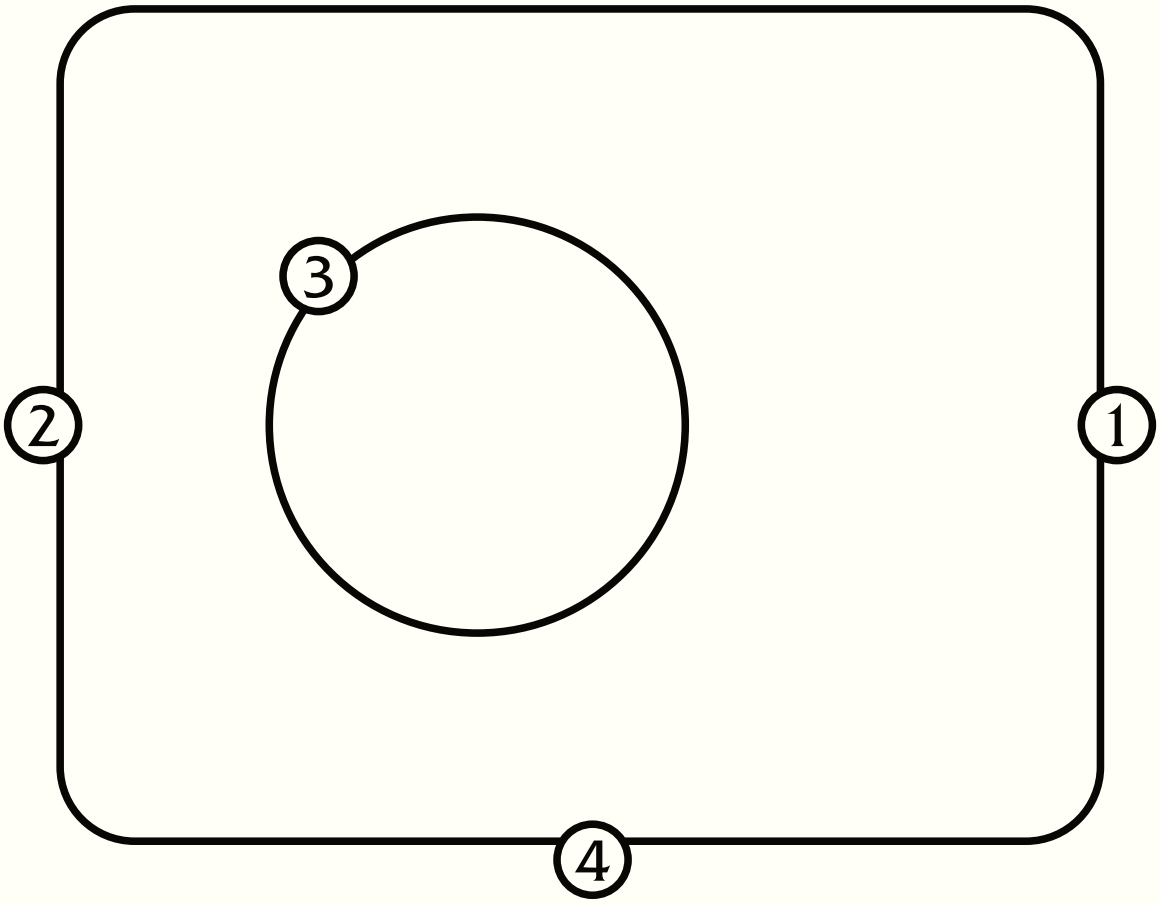
2. Audio Signal Output
   The audio signal output connection

   CUIS type: Orange

3. Samples To Average Value Dial
   Used for selecting the Samples To Average value

4. Voltage Samples To Average Value Control
   A voltage control input connection port which directly modifies the Samples To Average Value Dial (3). Control is between the values of 0 and 1.

   CUIS type: Green



Unit Specifications