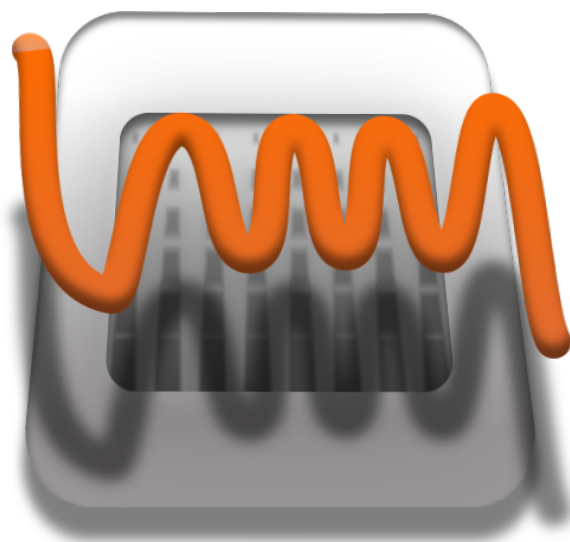

LAMA

LAMA Audio Measurement Application



User Manual for Version 1.34 1119

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1 Introduction

1.1 About LAMA

Thank you for your interest in LAMA -the "LAMA Audio Measurement Application"!

LAMA is a powerful software designed for acoustic measurements and Audio-System-Tuning in the field of live sound reinforcement.

It is exclusively designed for the Apple Macintosh and besides of technical perfection, usability has been a major design approach. LAMA brings powerful tools you will never want to miss at your live-sound desk.

Feedback We are very happy if you provide feedback to us, as it helps to make LAMA even better. In case of a crash, LAMA will ask you to send a crash-report. Please do so, as we can fix the bug which caused the issue – note that crash-reports sent to Apple are not forwarded to other developers.

64 Bit LAMA operates in 64 bit mode with Mac OS X Snow Leopard and takes full advantage of the CPU power of your Intel Macintosh.

1.1.1 Getting Started

Installation

There is no special installation procedure for LAMA. All you need to do, is to drag the application icon somewhere on to your computer's hard disk – the "Applications" folder might be a very good location for LAMA.

System Requirements

Macintosh To run LAMA, a Macintosh Computer with OS X Version 10.5 (Leopard) is required. Every Mac that is able to run Leopard should be able to run LAMA – so you need at least a 867 MHz G4 processor. All Intel Macs are able to run LAMA, too. (Lama is delivered as a "Universal Binary", so it works with PowerPC and Intel processors.)

Audio Requirements To run LAMA in 64-bit mode, Mac OS X 10.6 is required. Of course, an audio-measurement application needs some kind of audio-hardware to get audio-signals into your computer. The internal hardware is sufficient, but you might want to get some kind of more professional audio-equipment for serious work. Every Core-Audio compatible audio interface should be able to work with LAMA.

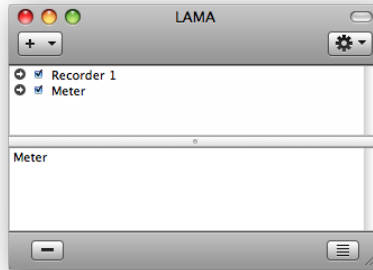
Support

→ A.1 Troubleshooting If you need any kind of technical support don't hesitate to contact the makers of LAMA: Visit the website <http://lama-audio.net/support> or send an email: contact@lama-audio.net.

1.2 Quick Start

→ 2.1 Main Window

When you launch LAMA for the first time, you will see the Main Window:



It consists of various parts: the toolbar on top and two tables: The upper one shows the currently active instruments and the one below those recently used. You can make one of the recent instruments active again, by double-clicking it. If you want to delete it, click the "-" button below or select the item and hit BACKSPACE on your keyboard.

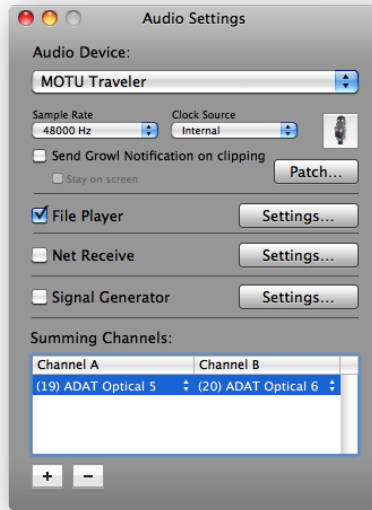
1.2.1 Audio Settings Window

Before you go on, you might want to adjust LAMA's Audio Settings to your need. Choose **View ▶ Audio Settings** or use the keyboard-shortcut **CMD-ENTER** to open the **Audio Settings** Window:

On the top you can see the **Audio Device** pop-up menu. It is used to select the audio-device which LAMA should use for input. Furthermore, you have the ability to create three different *Aux-Inputs* (File Player, Net Receive & Signal Generator) –additional "devices" that add audio input to your instruments– and *Summing-Channels*. Summing Channels – additional input channels with the sum and the difference of two other input channels. The Audio Device currently used can also be changed with the **Audio Settings** toolbar menu.

→ 4 Aux Inputs

Clip Notifications Enable **Send Growl Notification on Clipping** to be



informed with Growl when clipping occurs on one of the audio input channels. Growl is an external System Extension – for more information visit the website of the Growl Project.

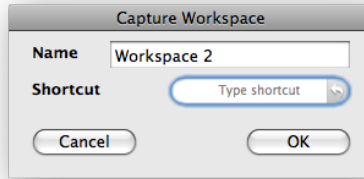
2 Basics

2.1 The Main Window

Active Instruments	In LAMA's Main Window (Instruments ▶ Main Window or CMD-M) you can create new instances of instruments by clicking the corresponding icon in the toolbar, and you can see an overview of the currently active and the recently created instruments. The upper table in the Main Window shows the current instruments – you can hide an instrument by unchecking the checkbox in the instrument-list. Hidden instruments are still active and supplied with audio-signal – so they still use power of your computer's CPU. To rename an instrument double-click the name in the active-instruments table and change it. The name in the list and the instrument window-title will change.
Renaming Instruments	
Recent Instruments	The lower table shows the list of <i>Recent</i> Instruments – when you close an instrument it will be added here. It is no longer active, has no audio input and won't consume any power of your CPU. To restore the instrument, double click it in the table – it will reappear on the screen exactly in the state it was when it has been closed.
Restoring Instruments	
Toolbar	You can configure the main window's toolbar right to your needs: For every kind of instrument, a toolbar item is available, additionally there is the Add Instrument item, which will open a menu where you can select the instrument you want to create. Like in other Macintosh Applications, you can configure the toolbar with View ▶ Customize Toolbar .

2.1.1 Workspaces

Capture Workspace	A workspace saves an arrangement of instruments which can be restored later – the instruments will appear again with the same window size & position and the same settings. To save a workspace, click Windows ▶ Workspace ▶ Capture Workspace . A window named Capture Workspace will appear.
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- Enter a name and (optionally) a keyboard-shortcut for the new workspace.
- Update Workspace** To update a workspace select **Update Current Workspace** in the **Windows ► Workspace** menu. It is possible to update a workspace before recalling an other one. To enable this, check the appropriate checkbox in the **Preferences Window**. (see 2.6)
- Renaming & deleting Workspaces** To rename or delete a workspace, open the **Workspace Editor** with the **Edit Workspace** item in the **Workspace** menu.
- Sticky Windows** Instrument windows have a button with a lock-symbol in the top-right corner. Use this to make a window *sticky*. These instruments (with the lock locked) are not affected by workspace recalls.

2.2 Creating Instruments

There are three ways to create new instruments:

- the **Instruments** menu
 - the keyboard shortcut of the instrument
 - the toolbar icon of the instrument
- You can change the appearance of the main window's toolbar by holding **CMD** and clicking the toolbar-icon in the upper right corner of the window.
- It is possible to create various instances of every type of instrument, e.g. with different settings, window-sizes, etc. The **FFT-Analyzer** (3.4) and the **Transfer Analyzer** (3.6) are able to show the results of several channels in a single window.

2.3 Instrument Switching

You can cycle the front instrument window (the one which will respond to keyboard events) by holding down the ALT key and pressing the CMD key, or - to cycle into the other direction - hold CMD and press ALT.

2.4 The Info Panel

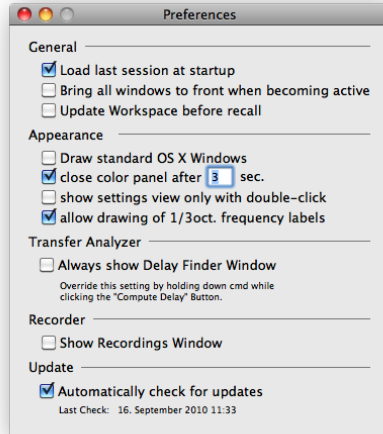
The Info Panel shows information of interest, like frequency & magnitude information of the mouse pointer in the active window, audio settings and more.

2.5 Some Hints

- Scroll Wheel LAMA provides wide support for the scroll-wheel of your mouse. Move the mouse over a slider or text field and adjust values by scrolling. This also works on modern trackpads by performing the "two-finger scroll". Speaking of trackpads: LAMA supports the "Zoom" command for some instruments. With a "three finger wipe" (or CMD-R) you can perform a "Reset" of the current instrument.
- Trackpad
- Window Snapping Instrument windows are designed to snap their borders to each other. If you want to turn off this behavior temporarily, hold down the ALT key while dragging the window.
- Parameter Linking When instrument windows of similar type have the same width or height like an other window it snaps to, they link their display parameters – e.g. you can snap a Spectrum Analyzer to a Spectral History and they display the same frequency & magnitude range. To prevent parameters from linking, hold down the ALT key while dragging the windows.
To unlink the parameters, simply move one of the linked windows to an other position.

2.6 Application Preferences

Select **LAMA ▶ Preferences (CMD-,)** To show a window with the Application Preferences.



Load last session at startup Check this, to continue exactly how you left it.

Bring all Windows to front... When this is checked, all windows will come front when LAMA was the inactive application and becomes active again.

Update Workspace before recall Before recalling an other workspace, the workspace currently active is updated (it's current state is stored). (see 2.1.1 Workspaces)

Draw standard OS X Windows Check this, if you prefer the native OS X windows style about LAMA's black windows. Note, that changes will affect only new created windows.

Close color panel after... If this is checked, color panels will be automatically closed after a specified amount of time.

Show settings view only with double-click Per default, LAMA will show the Instrument Settings View (3) when the mouse is moved into the lower area of the instrument window. You can disable this behaviour by checking this box. The Instrument Settings View can be shown or hidden by double clicking into the instrument view.

allow drawing of 1/3 oct. details As default, LAMA will draw a frequency label every octave (for instruments with a frequency domain.)

If this is checked, there will be a frequency label every third octave, when the window is big enough (820pixels wide).

Always show Delay Finder Window When this is checked, the Delay Finder will always open a window showing the impulse response.

Show Recordings Window When checked, the Recordings Window is automatically opened, when the recorder has been stopped.

Check For Updates Check this, and LAMA will check at startup if there is a newer version available.

2.7 Fullscreen Mode

LAMA provides a *Fullscreen Mode*, which hides other applications and displays all windows in front of a black background instead of your standard desktop wallpaper. To enter or leave the Fullscreen Mode, use **View ► Fullscreen Mode**, or keyboard shortcut SHIFT-CMD-F.

2.8 Input Patch

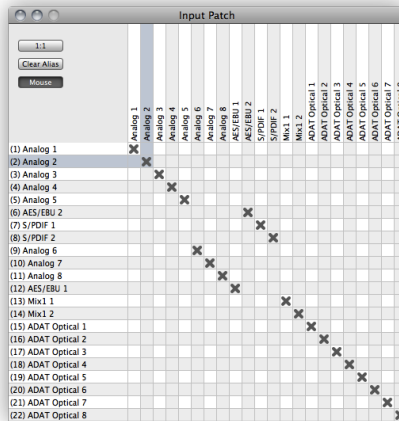
The *Input Patch Matrix* is the connection between the physical Audio device Inputs and the Inputs seen to Instruments in LAMA and it is the place where *Channel Name Aliases* can be assigned.

Let's imagine there is a Measurement Mic input on your system - one day it is connected to input "Analog 1" of your system, the other day to "Analog 8". Instead of re-assigning all instrument inputs to "Analog 8" simply re-patch destination channel "Analog 1" to physical input "Analog 8". For convenience re-name this input to something like "Measurement Mic" - this is the input name that instruments will show in audio-input menus.

2.8.1 The Patch Matrix Window

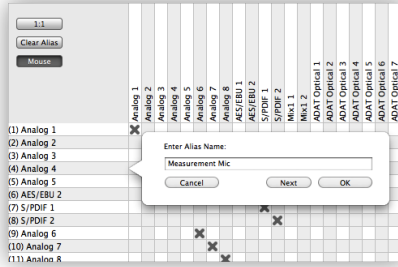
The *Input Patch Matrix Window* can be opened in the View ► Input Patch menu, or the Audio Settings Window

→ 1.2.1 Audio Settings Window



Patching The columns of the matrix are the physical device inputs, the rows are the software inputs seen by instruments. To patch, simply select a source/destination pair and click into the field or press the SPACE button on the keyboard. The destination channel will be renamed, unless an *alias name* is set (see below). The destination names are prefixed with the index number of the channel in brackets.

Alias Names By double-clicking the name of a destination channel, an *alias name* can be assigned to the channel - this name will appear in all input menus's in LAMA. After double-clicking on the name, a small window will appear on top which allows to enter the alias. The **Next** button in this window can be used to open the alias window for the next channel - for convenience this can also be done by pressing



Clearing an Alias **CMD-ALT-CURSOR DOWN** on the keyboard. To clear a channel alias, open the alias window as described above and enter an empty string. There is also the **Clear Alias** button in the patch matrix window which clears all aliases currently set.

Keyboard Operation It is possible to navigate through the patch window with the cursor buttons on the keyboard and patch with the **SPACE** or **ENTER** buttons (when using **ENTER** the next row & column will be selected after patching). It is possible to enable or disable mouse patching by switching the **Mouse** button on or off.

3 Instruments

In LAMA you can create different kinds of instruments:

- Meter - shows audio levels.
- Goniometer - shows a Lissajous of the left and right channel from a stereo signal.
- Level History - shows the history of peak and RMS level of a audio signal a the distribution of the values.
- Spectrum Analyzer - shows the current audio spectrum of one or more audio channels.
- Spectral History - shows the audio spectrum of the recent past of a audio channel.
- Transfer Analyzer - shows frequency and phase response of an acoustic system.
- SPL Meter - shows the Sound Pressure Level
- Recorder - records audio to a file

You can create as many instances of an instrument-type as you like. To create one, use the **Instruments** menu, keyboard-shortcut or the main-window toolbar.

Instrument Settings

All Instruments provide a *Settings View* – to show it, make the instrument-window active and move the mouse into the lower area of the window – the settings view will now appear in the instrument window.

The Settings View can also be shown or hidden by a double-click into the instrument view. The automatic appearance of the Settings View can be disapled in the Application Preferences (see 2.6 Application Preferences).

This view usually shows the most important settings – like frequency or power range. For more complex settings, some instruments provide a *Control Panel* .



To show the control panel, click the settings icon in the instrument *Settings View*. You can also click the settings

icon at the top-right corner of the instrument window or hit the keyboard-shortcut CMD-I.

3.1 Input Meter



The input meter provides a way to monitor the audio-levels at the input of your audio-interface. It shows the peak and RMS Level.

RMS Level

The RMS (*Root Mean Square*) Level is the amount of *energy* in the audio signal. The RMS Level is the solid bar in the meter. The integration time for calculating RMS is 150 milliseconds.

Peak Level

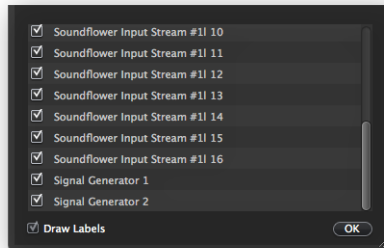
The Peak Level indicates the maximum of the audio signal and is shown as a line in the meter view. This value is interesting when setting the input gain of your audio device to prevent signals from clipping.

Clipping Indicators

When input peak levels reach the maximum level of $0dB_{FS}$, the *Clipping Indicators* turn red. To reset, click into them or perform a Instrument Reset.

3.1.1 Meter Settings

When you open the meter's settings window, you'll see something like the following:



Hiding Channels

In the top you can see a table which displays the names of all available input channels. On the left of each channel-name you can see a checkbox – uncheck channels which should not be displayed in the meter window here.

- ▶ Hold down the ALT button, to apply this to all channels. Furthermore it is possible to navigate through the table with the cursor keys and toggle the visibility status with the SPACE button.

Draw Labels

The "Draw Labels" checkbox sets if the name of each channel should be shown inside the meter. This is probably a good idea if your meter consists of very much chan-

nels. When the labels are not shown although you've checked this setting, there is probably insufficient vertical space in the meter's window. Just resize it, and the labels will be shown.

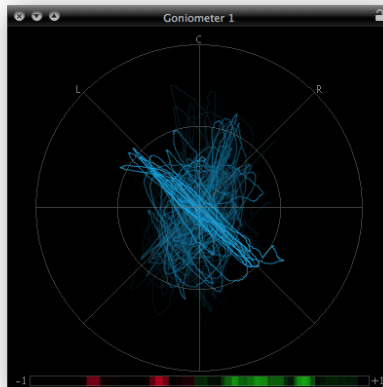
3.2 Goniometer



The Goniometer shows the stereo image of a stereo signal and helps to avoid cancellations when the stereo signal is summed mono – by showing possible cancellations. You can create a new Goniometer with the toolbar icon, the main menu (**Instruments** ► **Goniometer**) or the keyboard-shortcut **SHIFT-G**.

Setting Channels

As there are only two parameters (left & right channel) for the goniometer-instrument there is no special settings-window. To set left or right channel, make the Goniometer Window active and move the mouse to the lower part of the window. The instrument control view with two pop-up menus for the audio channels will appear.



Correlation Check **Show Correlation** to display the correlation of the input signals. A Value of +1 means that the signals are identical (mono), -1 indicates a phase reverse.

3.3 Level History & Level Distribution

The *Level History Instrument* shows level history on the left and level distribution on the right.

3.3.1 Level History



The Level History Instrument shows the *Peak*- and *RMS* Level (see 3.1, Input Meter) of the recent past. The peak level is shown as a solid line, the RMS level is the filled path.



Settings Use the **Integration Time** slider to change the time used for RMS integration & calculation. **Input** changes the audio input, **Speed** changes the display speed of the instrument.

3.3.2 Level Distribution

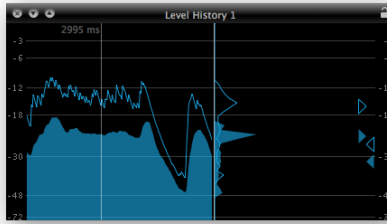
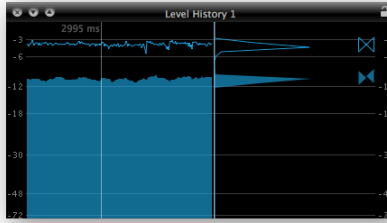
On the right of the Instrument, you can see the *Level Distribution*. It shows, how often a certain level existed in the last time. Main purpose of the Level Distribution is to:

- See the dynamic range of the programme
- See the perceived programme loudness

Examining the Dynamic Range

Here are two screenshots of the Level Distribution Instrument, one with very compressed programme (*Red Hot Chili Peppers – Californication*), one with a high dynamic range (*Beethoven – Allegro Con Brio*).

Adjusting Time Window In the *Level History* view on the right, there is a white marker which allows to set the time window of the distribution. It can be adjusted by dragging and dropping it in the view.



Examining the perceived Programme Loudness

For the *perceived loudness* the 50%-percentile of the *distribution* is of special interest – it shows a very high relation to the perceived loudness when measured over a window of 3 seconds.

In LAMA's distribution view, the 50%-percentile is shown with the two little right-facing triangles. Those two facing left, show the current peak and rms level.

3.4 Spectrum Analyzer



With the Spectrum Analyzer you can view the frequency-spectrum of an audio signal. You can view multiple channels in a single window.

3.4.1 About FFT Measurements

FFT (Fast Fourier Transformation) is used for all spectral measurements in LAMA. FFT provides a fast way to get spectral information of an audio-signal. But note, that the resolution of a FFT measurement is linear - the nature of sound would prefer a logarithmic resolution. This means that the resolution for lower frequencies is always much poorer than for high frequencies (where resolution is much to high). So, can you trust the information that LAMA provides? When you work with a FFT-Window-Size of 16384 points and a Sample-Rate of 44100Hz you get an absolute resolution of about 2.7 Hz, which will be sufficient as long as you are not dealing with super-low end.

3.4.2 FFT Basics

Each FFT Analyzer instrument can display the audio-spectrum of multiple input-channels. For each channel you can view the instantaneous, the average and the peak spectrum. Resolution can be shown in continuous mode or in ISO-octaves. Other important settings are the *FFT-Window-Size* and the *FFT-Window-Function*

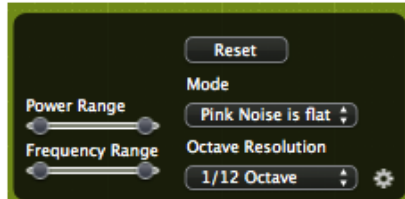
FFT-Window-Size LAMA's FFT-Window-Size can be adjusted between 8192 and 65536 points. As more points you use, as higher the spectral resolution will be. Of course, longer FFT-Sizes will be slower - you can choose between resolution in the time or in the frequency domain.

FFT-Window-Function A FFT would require that the number of samples of one or more periods of the test signal are exactly the number of FFT Points. Of course, this is never the case with music or speech signals. The resulting effect is called "*Spectral Leaking*". To minimize this effect, a *Window Function* is applied before every FFT process. You can select between various Window Functions.

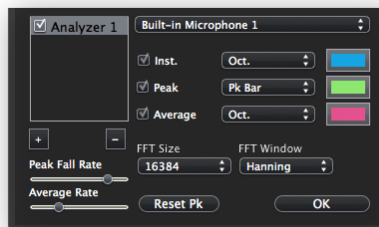
- For normal music material, a *Hanning* Window is recommended.

3.4.3 Settings

To show the settings of the FFT Analyzer, make the analyzer window active and move the mouse into the lower part of the window. The FFT Settings View will appear:



Here you can change the frequency & magnitude range plus the octave-resolution for traces which are displayed in octave mode. For settings like the input-channel or display-mode you need to open the settings panel: click the settings icon in the lower right corner of the FFT Settings View or the in the top-right corner of the instrument-window. The Settings-Window will appear.



Adding & Removing
Channels
Traces

On the left you can see a table which shows all channels in the analyzer-window. To add or remove a channel, use the + or - button below the table. To change the audio-input of a channel, use the input popup-menu in the upper area of the settings window. For each analyzer-channel you can display three different curves: The instantaneous, the average and the peak curve. Use the **Average Rate** slider to make averaging faster or slower and use the **Pk Reset** button to reset the peak trace. The fall time of the Peak Trace can be adjusted with the **Peak Fall Rate** slider.

Display Options For each trace you will find a checkbox which allows to

set if the trace should be drawn or not and a color-well to set the color of the trace. Furthermore you can set the display-mode of the trace: **Cont.** for continuous stroke (single line), **Fill** for a filled, continuous curve, or **Oct** to display the values in ISO-Octaves. Use **Pk Bar** to draw a octave-weighted line.

Changing the Amplitude Range You can change the amplitude range of FFT & Transfer windows with the mouse scroll-wheel or by dragging the background of the analyzer-window up or down – when you do so in the lower or the upper area of the window, only the lower or upper bound of the magnitude range is affected. With multitouch trackpads you can also perform a "zoom" with two fingers.

Showing Frequency Details Use the **Format ▶ Frequency Details** menu to show details about the current cursor position in the window.

Mode

As a FFT measurement has a linear distribution over frequency and we as humans are interested in a logarithmic display there are way too much -or more as displayable- FFT-points in the upper part of the audio spectrum – so there has to be a way to reduce the points and to make the result visible. The **Mode** Setting changes the way LAMA performs this reduction. This sets the *Accumulation Mode* of the display:

White Noise is flat : Shows the mean average of the magnitudes in the corresponding band.

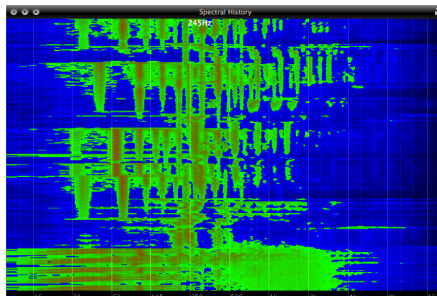
Pink Noise is flat : Shows the mean average of the energy in the corresponding band. This relates to the way the human ear perceives a sound.

Peak : Show the maximum average in the corresponding band.

3.5 Spectral History



The Spectral History Instrument shows the spectrum of an audio channel during the recent past. The intensity of the level is shown by different colors.

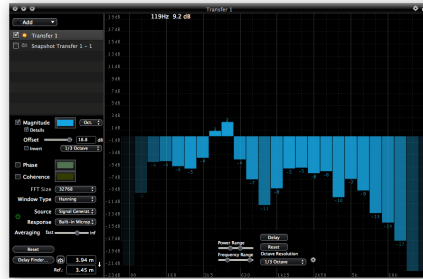


To change settings, make the Spectral History window active, and move the mouse into the lower part of the window – The settings view will appear. Here you can adjust frequency and power range & the channel to analyze. The Spectral History Instrument can only show a single channel per instrument, but of course you can create multiple instances of them.

3.6 Transfer Analyzer



The Transfer Analyzer allows you to determine frequency & phase response of acoustical or electrical systems, like preamps, equalizers or a venue with speakers.



Source Independent Transfer measurements in LAMA work independent from your source signal (unlike other applications which require a special test-tone). To be able to do the measurement, LAMA needs two sources for each measurement: The *Source Signal*, which is the signal at the input of your system (when the system is a room, this would be the mixing desk output) and the *Response Signal* which is signal at the output of the system (in the same example this would be the output of a measurement microphone). When setup, you get three different results: the *Magnitude*, *Phase* and the *Coherence Trace*.

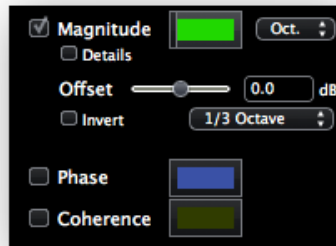
Coherence The Coherence is of particular interest: It shows how the response signal relates to the source signal – you can interpret it as the "quality" of the measurement. Reasons for low coherence (or bad quality) can be noise or other unrelated signals in the response signal - like a loud audience or the reverb of the room. An other reason might be cancellation of particular frequencies at your measurement microphone (comb filtering) - as these frequencies are not available in the response signal, the response of these frequencies can't be determined. To improve readability of the magnitude trace, it's opacity depends on the coherence. This means that it will be faded out in areas with low coherence. To improve coherence of your measurement, it is important to have source & response signal time aligned. Usually the response signal will be late (time delay between speakers & measurement micro-

→ 3.6.4 phone), so LAMA provides a delay for the source signal to have it aligned to the response signal. See the Section Delay Finder to learn how LAMA can achieve automatic time-alignment for you.

3.6.1 About Transfer Measurements

→ 2.2 A Transfer Analyzer is created with the toolbar of LAMA's Main Window , the Main Menu (**Instruments ▶ Transfer**) or with the keyboard shortcut SHIFT-T.

→ 3.6.3 Every Transfer Analyzer Window can hold various Real-time Analyzers, Snapshots, Averages and a special kind of average-snapshot, the *Accumulator*. Some settings are common for all types:



Magnitude Options

Offset

Invert

Smoothing

For each trace (Magnitude, Phase & Coherence) you can find a checkbox which sets if this trace should be drawn or not and a color-well to select an other color for the trace. For the magnitude trace you have some more options: You can select if you want the result being shown as a single, continuous path (Cont.), as a filled continuous path (Fill) or if you prefer the result in ISO-Octaves (Oct.). The **Offset** parameter adds an offset on the result, **Invert** inverts the result. The magnitude curve is always smoothed in fractions of octaves, use the pop-up menu or keyboard shortcut to set the smoothing amount.

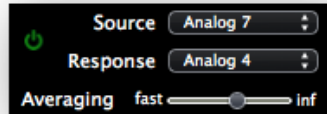
- ▶ You can use M, P or C key to show/hide magnitude, phase or coherence curve.

3.6.2 Realtime Transfer Measurements



→ 3.6.1

Realtime measurements are performed with signals currently fed into LAMA, and are represented with the icon shown on the left. Besides the parameters introduced at the beginning of this chapter you can see some more options:



- | | |
|-------|--|
| → 3.6 | <p>Input Channels There are two pop-up menus named Source Channel & Response Channel, which are used to set Source & Response channel of the measurement.</p> <p>Averaging The Averaging slider sets, how fast a realtime-measurement is averaged, the maximum value at the right is infinite. When infinite averaging is selected, you have to reset the analyzer manually by clicking the Reset button.</p> <p>Reset Additionally you can find a parameter named When fundamental parameters of your acoustic environment have changed, it may be necessary to reset the transfer analyzer by clicking the Reset button. When the delay time is changed, a reset is automatically invoked.</p> <p>Pause The "Power Switch" gives the opportunity to stop a realtime measurement – it will remain with it's current data.</p> <ul style="list-style-type: none">▶ CMD- Click the power switch to toggle the signal-generator's Mute switch. Use keyboard shortcut O to toggle the measurement's pause status. <p>Delay Time The reference and measurement signal must be time-aligned in order to get good measurement results. The delay time is set in the delay time settings view.</p> <ul style="list-style-type: none">▶ Usually, there is no need to enter delay times manually, you should always use the <i>Delay Finder</i> to calculate delay times. When the delay finder fails, this is usually an indication that something is wrong with your measurement setup. <p>For more details, have a look into the <i>Delay Finder</i> section in this manual.</p> |
|-------|--|



Delay Time Reference A delaytime reference point can be entered into the **Ref.** text-field. The displayed delay time is relative to this reference point.

3.6.3 Snapshots



You can create a snapshot of a realtime measurement by clicking the snapshot icon in the toolbar of the transfer settings view.

Snapshots save the current state of the measurement and can be used to create averages of two or more snapshots.

Averages



If you do room correction you will get (more or less) different results on every different position in the room. If you have created various snapshots on different positions, you can use the average item in the toolbar to build the average of the selected snapshots.

- ▶ An easier way to achieve this can be to make use of the *Accumulator*, as described below.

The Accumulator



As mentioned above, it is recommended and required to do measurements on more than one point in the room and to average them, when you are trying to do room-correction. The *Accumulator* makes this very easy for you – it is a kind of growing average-memory. When the measurement on a specific point is set up and ready, simply click the *push to accumulator* icon in the toolbar. The selected measurement will be added to the accu and averaged with all other measurements there.

- ▶ Click **Reset** to reset the Accu. (On some trackpads you can use the three-finger-wipe to reset.)

Snapshot Differences



Snapshot Differences display the difference of two snapshots. To create one, select two snapshots in the source list, and click the delta icon in the toolbar.

3.6.4 Delay Finder

As mentioned above, it is important that source and response signal are time aligned. LAMA has the *Delay Finder*, to compute the delay between source & response channel. You can start the process by clicking the **Compute Delay** button. As the delay finder needs signal to work, the delay computation is triggered when both source- and the response signal exceed a level of $-26dB_{FS}$.

Delay computation works best with static broadband noise. When the delay-computation is finished the text-field in the lower right corner of the transfer-settings window will show the calculated delay-time.

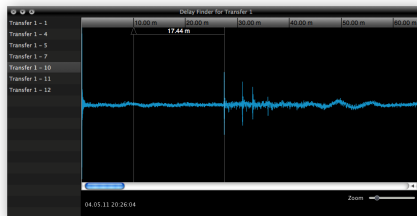
If you want to change the delay time manually, just enter an other value into the text-field. You can change the distance-unit in the **Format ▶ Distances** menu.

- ▶ You can enter a value in an other unit by adding the suffix "m", "ft", "msec" or "smp" (for meter, feet, milliseconds, or samples) to the number you enter.

Viewing Results

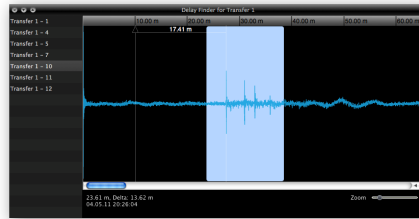
If you are not sure if the result of the delay finder is correct you can view its results in a separate window. Click the settings button next to the **Compute Delay** to open the delay-finder window. (Note: you can set in LAMA's **Preferences** to always open a delay-finder window, or you can hold down the **CMD** key when clicking the **Compute Delay** button.)

In the delay finder window you can see the impulse response of the tested system.



By default, LAMA sets the delay-time to the highest peak in the impulse response. Now, you can change the delay-

- time, by simply clicking to an other position in the delay-finder window. To set the delay time to the peak in a particular range, select the area that is interesting for you. Now the delay time will be at the maximum-value in this area.
- ▶ Hold down the CMD key while selecting to zoom into the selected area.



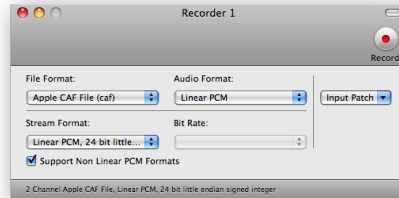
Keyboard Shortcuts The following keyboard shortcuts are available in the delay finder window:

- CURSOR LEFT Scroll left
 - CURSOR RIGHT Scroll right
 - CURSOR UP Increase Delay Time
 - CURSOR DOWN Decrease Delay Time
 - CMD-CURSOR UP Increase Reference Point time
 - CMD-CURSOR DOWN Decrease Reference Point time
 - CMD-CURSOR LEFT Zoom Out
 - CMD-CURSOR RIGHT Zoom In
 - ALT-CURSOR LEFT Jump to Reference Point
 - ALT-CURSOR RIGHT Jump to Delay Time Point
 - SHIFT-CMD-0 Reset View – Zoom to a level where reference point and delay time are on screen.
- ▶ Holding down the SHIFT key increases the amount applied, when scrolling or moving delay or reference points.

3.7 Recorder



With the Recorder you can save audio signals to an audio-file. The audio-file-recorder that comes with LAMA supports a wide range of file & format types. Open the recorder to see a list of available file-formats.



Non-Linear PCM Formats

The recorder is able to record compressed formats like *AAC*. Please note that recording of such *Non-Linear PCM Formats* requires much more CPU-Power than recording Linear PCM. Use the **Support Non-Linear PCM formats** checkbox to enable the recorder to record such types (and show them in the list of available formats.)

Multichannel Files

With LAMA's recorder, you can record multichannel-files. The number of available channels is dependent on file & audio format.

! →

Please note, that not every other audio-program is compatible with every type of audio-file. You might want to check before making an important recording.

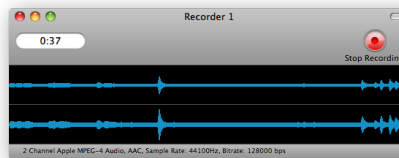
Input Patch

With the **Input Patch** menu you can select the number of channels for you audio file, and which input-channel should be routed into which destination channel in the file. You can navigate thru the path menu with the cursor-keys, and patch with the **SPACE** or **ENTER** key. To achieve a 1:1 routing, double-click at the start-patch point.

Recording



To start recording, click the **Record** button in the toolbar. The recorder view will change, and show a waveform overview of the channels currently recorded.



3.7.1 Recordings Window

→ 4.1.1

The **Recordings Window** shows recently recorded files. It is possible to add a recording to the File Player by simply dragging the recording from the Recordings Window & dropping it on the File Player's file list.

A recording's file can be revealed in the Finder by double-clicking on the file. Recordings can be removed from the list by selecting an item hitting backspace on the keyboard or choosing **Edit ▶ Delete**.

Open Recordings
Window
automatically

As described in Section 2.6, you can check **Show Recordings Window** in **LAMA Preferences** to open the Recordings Window automatically when a recording is stopped.

3.8 Sound Pressure Level (SPL) Meter

3.8.1 Introduction

! → The Sound Pressure Level Meter may not meet the legal requirements of your local authorities!

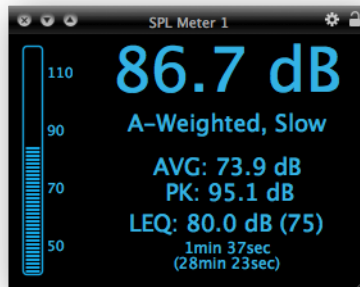


The SPL-Meter shows the current, averaged and peak Sound Pressure Level, computed with a user-settable weighting curve. Besides the current SPL, it shows the following:

AVG The arithmetic average, averaging time is settable in a range from 10 seconds to 30 minutes.

PK Peak SPL - use Instrument Reset to reset peak.

LEQ *Equivalent Continuous Sound Pressure Level* or *Sound Exposure Level*. It is reset after a certain period which can be adjusted by the user. The SPL Meter displays the time since it has been reset and when the next reset will occur - the remaining time until reset is shown in brackets.



The following parameters are adjustable:

- Weighting Curve:

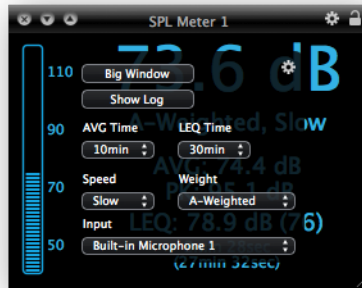
- dB(A)
- dB(B)
- dB(C)

- Speed:

FAST Measurement Time 125 ms

SLOW Measurement Time 1.2 sec

- Average Rate, in a range of 10sec to 30min

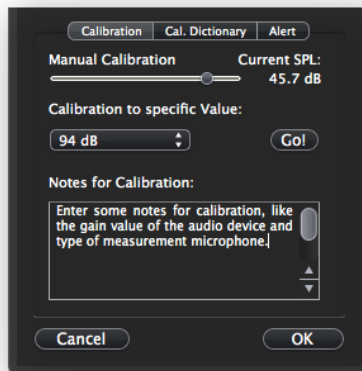


Reset Peak To reset the Peak Value, simply perform **Reset Instrument**, either in the **Edit** menu, the keyboard shortcut **CMD-R** or a "three-finger-wipe" gesture on your trackpad.

LEQ Prediction Based on the linear average of the last minute, a predicted LEQ value is calculated and displayed. This is the value shown in brackets in the *LEQ* line.

3.8.2 Calibration

The SPL-Meter needs to be calibrated before it can be used, as the level depends on the measurement microphone and audio interface being used. To start the calibration process, open the settings view of the SPL Meter:



Manual Calibration

On top of the calibration view, you can see a slider named **Manual Calibration** and a text field named **Current SPL**. Use these for "quick & dirty" calibration:

- Bring your measurement mic as close as possible to the mic of an other, calibrated SPL Meter
- Adjust the slider until the **Current SPL** textfield shows the same value as the calibrated SPL Meter. *(Make sure that weighting-curve and measurement speed match)*
- Click **OK**

Calibration with a known SPL

When you want to calibrate to a known Sound Pressure Level - like with a SPL-Calibrator, use the **Calibration to a specific Value** area of the Calibration Window.

- Choose the appropriate SPL in the menu (select **Custom** to enter a custom value)
- Expose your microphone to the sound-field (plug it into the calibrator)
- Click **GO!**

Notes for Calibration

Once calibrated, you might want to use the same setup again. The **Notes for Calibration** text-area allows to enter some notes (like the type of the measurement mic used and the gain-settings of your audio-interface). that will help to reproduce the setup you have calibrated.

Reusing Calibration

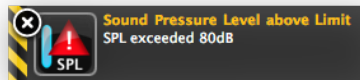
To apply settings from a setup that once has been calibrated, click **Cal. Dictionary** in the calibration window.

You can see a menu, showing calibrations done with the current audio interface. To reuse this value, select one and click **OK**.



3.8.3 SPL Alert

If you want to, you can be alerted when the sound pressure level exceeds a certain limit. You will be alerted with a GROWL notification.

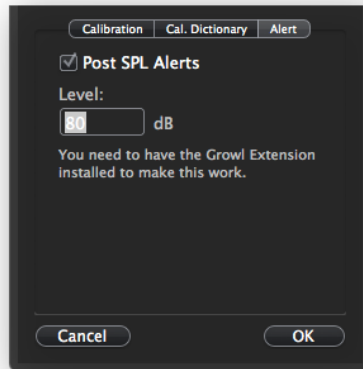


Growl is an external system extension, which needs to be installed to make this feature work. For more information, visit the Growl website. The advantage of Growl is that notifications can be forwarded to an other computer by network, SMS, etc.

To enable SPL Alert and set the alert level, open the SPL Meter Settings Window, and select the **Alert** Tab:

There is a checkbox **Post SPL Alerts** which allows to enable or disable alerts. The desired alert level must be entered in the **Level** text-field.

! → Only one SPL alert will be posted each time. The Growl Notification window must be dismissed to receive a new alert.



3.8.4 Big SPL Window

Every instance of a SPL Meter instrument allows to open one or more *Big SPL Windows*. It is created with the **Big Window** button in the control view of the SPL instrument. A big SPL window displays the current *SPL*, *AVG*, *LEQ* or *Peak* value. Contrary to the SPL Main Window, these are resizable – this way a bigger readout for the numbers can be achieved.

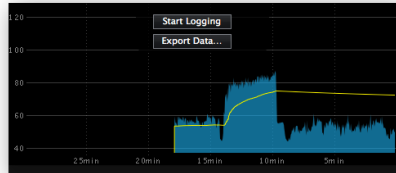


SPL "Traffic Light" The big SPL Windows allow to set a threshold for a warning and a alert level. The number readout will change color if the current level is above this threshold.

3.8.5 SPL Logging

This logs the instantaneous, average and LEQ Level. Data is stored on disk and can be exported later as *.csv* file.

Use the **Show Log** button in the SPL Instrument settings view to show the *SPL Logging View*.



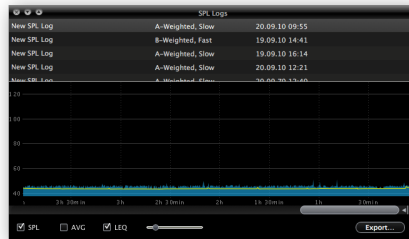
The SPL Logging View has it's own settings view, where you can set colors for traces and show or hide them.

Starting Log

To start SPL Logging, simply click the **Start Logging** Button in the SPL Logging View. You can hide the logging view if you want while it is logging.

3.8.6 SPL Log Window

When a SPL Log is stopped it will be saved automatically. *SPL Log Window* will show all logs that have been saved.



This window can be opened with **Windows - SPL Log** or keyboard shortcut **ALT-SHIFT-L**

Naming Logs

Every Log item can be named individually *e.g.* "Rehearsal", "Show",... by double-click on the name in the log-table. Log items can also be deleted, by selecting **Edit - Delete** or the *Delete* button.

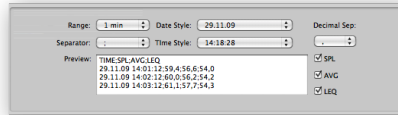
Delete Logs

Export Log Data

In the SPL Log Window, SPL data can also be exported

as *.csv* file – these can be easily imported into a spreadsheet application like Open Office.

Select a log item and click **Export...** – a save sheet will appear in the window. The following export options are available:



Range The export range. LAMA logs SPL level's every second. If you want to export with a resolution of one minute for example, set this value to *1 min.*

Separator You can use ";", ",", or a tab-character as column-separator.

Date Style The Date style for the export data.

Time Style Time style for the export data.

Decimal Sep Set if you want a point "." or colon ":" as decimal separator in the export data.

SPL, AVG & LEQ Check which data to export.

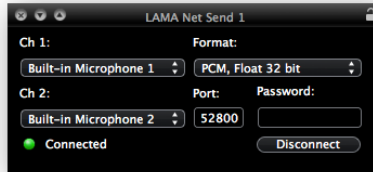
Preview This shows how the exported data will look like.

3.9 Netsend Instrument



The Netsend Instrument uses the system supplied *AUNet-Send* Audio Unit to stream audio signals over network. The audio stream sent can be received with the *AUNet-Receive* Audio Unit, like with the *Net Receive* instance in LAMA.

→ 4.1.1



You can set two input channels for the Audio Stream (Ch 1 & Ch 2), a network Port, the Stream Format and a password.

! → Currently (Mac OS X 10.6.2) there are some issues with certain kinds of stream formats when LAMA is in 64 bit mode. You can launch LAMA in 32 bit mode if this is a problem. However, Linear PCM formats work fine in 64 bit mode.

3.10 Oscilloscope



The oscilloscope shows the audio signal of two different channels.

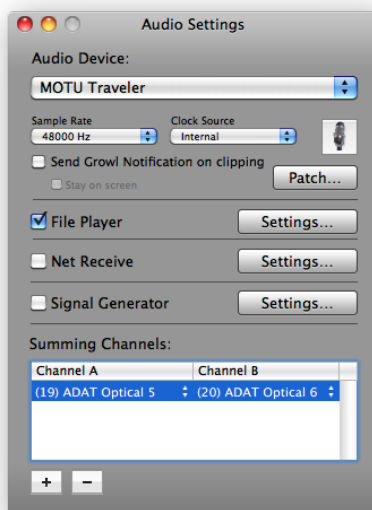


- Input** In the top area of the control view you can find two popup-menus to select the audio-input of oscilloscope channel 1 & 2. Use the checkbox left to the labels to set if the channel should be shown or not.
- Trigger** Use the **Trigger Source** menu to set to trigger on channel one or two. The oscilloscope's view will be redrawn when the level on the trigger channel exceeds the level set with the **Trigger Level** slider.
- Time Resolution** On the bottom of the oscilloscope control view, there are two popup-menus to set the time-resolution of the oscilloscope. The one on the right sets the unit (either samples per division – *smp/div* or microseconds per division – *usec/div*)

4 Aux Inputs & Additional Channels

4.1 Audio Settings

Audio Settings Window The **Audio Settings Window** is the place where you can select the audio device which will be used for input and where you can create Summing channels or an instance of *File Player*, *Net Receive* or the *Signal Generator*.



4.1.1 Auxiliary Inputs

If you need to do measurements with audio signals from an other source than your audio-interface, - e.g. the content of an audio file on your hard disk - LAMA has three different kinds of "auxiliary" inputs: file-player, net-receive unit and the signal generator. The audio signal of these aux-inputs (which is always a stereo signal) is routed into LAMA and can be treated in the same way as a

Default Stereo Output "normal" input-channel of your audio-device. Additionally, their signal is fed to the default stereo-output of your Macintosh. The stereo-output can be set with the **Audio MIDI Setup** application which can be found in the *Utilities* folder inside the *Applications* folder on your Macintosh hard disk.

! → Please make sure that this output-device is working with the same Sample Rate as the input-device currently used by LAMA.

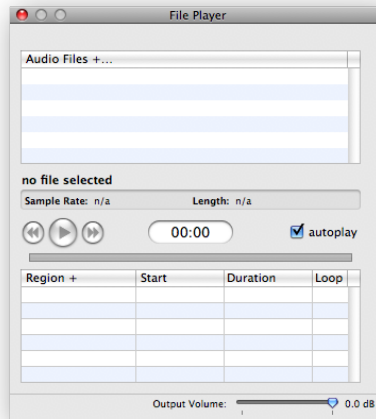
Creating Aux Inputs Auxiliary Inputs are created in the **Audio Settings** Window. Just check the box of the appropriate type you want to create and it will be active. To show the window of the aux input, click its **Settings** Button. Note that only one instance of each type can be created.

! → Note, that Aux-Inputs use CPU-Power – you should deactivate them if they are not needed in the **Audio Settings** Window.

As creating or removing Aux-Inputs changes the audio-configuration in LAMA (which requires stopping & restarting the audio-engine) it is not possible to create or remove them while a recorder is recording.

File Player

With the File Player you can play back audio files:



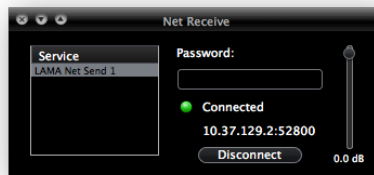
Drag audio-files from the finder and drop them on the **Audio Files** table, use the transport buttons to start or

Volume pause playback. Use the **Output Volume** slider to adjust the volume that is fed to the stereo-output – Note that the level to the output is independent to the level fed to LAMA internally (which is always the maximum level).

Net Receive

→ 3.9

The Net Receive Unit works in conjunction with the **AUNetSend** Audio Unit or the *Netsend Instrument* in LAMA . It makes it possible to stream audio-data over a TCP/IP network. Setup an other computer with AUNetSend and LAMA will be able to receive the sent audio-stream.



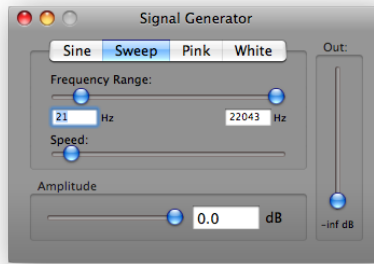
Signal Generator

LAMA's integrated Signal Generator can generate test-signals of the following types:

- Sine Wave
- Sine Sweeps
- Pink Noise
- White Noise

Select the tab with the kind of signal you like and adjust its settings.

Levels The **Amplitude** slider sets the level with which the signal is being generated and fed into LAMA's Instruments, the **Out** slider sets the level which is fed to your output. To prevent your ears and nerves from damage, the **Out** slider is always in -Infinite position when you create the signal generator.



4.1.2 Summing Channels

When you need to do measurements that depend on the sum or the difference of two other channels, you can create a "Summing Channel". A Summing Channel is an additional input to LAMA with Sum & difference of two other audio-channels. They are created in the **Audio Settings** Window (by clicking the + button at the bottom of the window) and select two channels for it. The sum and the difference of these channels will be fed into LAMA's instruments as two additional audio channels. If you want to remove them, select the channel and click the - button.

! → Note, that Summing Channels use CPU-Power – you should deactivate them if they are not needed in the **Audio Settings** Window.

As creating or removing Summing Channels changes the audio-configuration in LAMA (which requires stopping & restarting the audio-engine) it is not possible to create or remove them while a recorder is recording.

Appendix A Appendix

A.1 Troubleshooting

- If you do experience ongoing troubles with LAMA, please contact us: contact@lama-audio.net.
- Delete Preferences You might want to try trashing LAMA's preferences file, which can be found in *Home/Library/Preferences/com.nobusiness-soft.LAMA*.
- Last Session The settings of your last session are stored in a file name *lastsession.lama* which can be found at *Home/Library/Application Support/LAMA*. It might cause problems at startup, when this file is corrupted.
- Starting in 32bit mode Some problems might be specific to 64bit operation – there is a known issue that certain stream formats in AUNetSend a AUNetReceive do not work correctly when LAMA is in 64bit mode.
To start LAMA in 32bit mode, select the application icon in the Finder and show the Info Panel (CMD-I) You can find a checkbox regarding 32 bit operation there – check it and relaunch LAMA.
- License When starting LAMA for the first time, you will be able to try it for 30 days without any restrictions. Note that LAMA has to communicate with our server on the internet to do so. Of course your privacy is fully respected.

A.2 License

A.2.1 End User License Agreement

License Grant	<p>"You" means the person or company who is being licensed to use the Software or Documentation. "We," "us" and "our" means Ulrich Zurucker.</p> <p>We hereby grant you a nonexclusive license to use the Software by one person. The software may be installed on as many computers as necessary, provided that you have a license for each person using the software.</p>
Title	<p>We remain the owner of all right, title and interest in the Software and related explanatory written materials ("Documentation"). To the extent permitted by applicable law,</p>
Limited Warranty	<p>THE FOREGOING LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, AND WE DISCLAIM ANY AND ALL IMPLIED WARRANTIES OR CONDITIONS, INCLUDING ANY IMPLIED WARRANTY OF TITLE, NONINFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, regardless of whether we know or had reason to know of your particular needs. No employee, agent, dealer or distributor of ours is authorized to modify this limited warranty, nor to make any additional warranties.</p> <p>SOME STATES DO NOT ALLOW THE LIMITATION OR EXCLUSION OF LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.</p>
Limited Remedy	<p>Our entire liability and your exclusive remedy for breach of the foregoing warranty shall be, at our option, to either:</p> <ul style="list-style-type: none">• return the price you paid, or• repair or replace the Software or media that does not meet the foregoing warranty. <p>IN NO EVENT WILL WE BE LIABLE TO YOU FOR ANY DAMAGES, INCLUDING ANY LOST PROFITS, LOST SAVINGS, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING FROM THE USE OR THE INABILITY TO USE THE SOFTWARE (EVEN IF WE OR AN AUTHORIZED DEALER OR DISTRIBUTOR HAS BEEN ADVISED OF THE POSSIBILITY OF THESE DAMAGES), OR FOR ANY CLAIM BY ANY OTHER PARTY.</p>

Term and
Termination

SOME STATES DO NOT ALLOW THE LIMITATION OR EXCLUSION OF LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU. This license agreement takes effect upon your use of the software and remains effective until terminated. You may terminate it at any time by destroying all copies of the Software and Documentation in your possession. It will also automatically terminate if you fail to comply with any term or condition of this license agreement. You agree on termination of this license to destroy all copies of the Software and Documentation in your possession.

A.2.2 Privacy

The makers of LAMA fully respect your privacy. LAMA will send data over the internet in some cases:

- When starting without a valid license, the serial number of your computer will be sent.
- When checking for updates, LAMA sends some technical information about your computer hardware – we use this for statistical purposes.
- When sending crash reports some technical information is sent too.

LAMA will never send data in other cases then those described above and will never use any private information saved on your computer. Please contact us, if there are any questions left on privacy.

A.2.3 Contact Information

For legal questions, please contact us:
Ulrich Zurucker
Tengstr. 8
80798 Munich - Germany

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