LUFS Meter Manual

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Introduction

What can the LUFS Meter be used for?

1. The LUFS Meter enables you to deliver loudness compliant material. It is a software plugin that measures loudness according to the specifications

of ITU-R BS.1770 and EBU R128. It also complies to many other loudness recommendations.

2. The LUFS Meter measures loudness similar to the human perception of loudness. It can adjust the loudness to a desired value. This helps to compare different pieces of audio. Or to match multiple tracks for an album or a show.

3. Multiple LUFS Meters can be used and controlled simultaneously thanks to the unique synchronization feature. This provides a fast mechanism to set each track of a project to the same loudness - a so called faders up mix.

4. It is also well suited to monitor the loudness in live and broadcast applications.

Modern loudness measurement

In contrast to earlier approches, modern loudness measurement is quite close to the human perception of loudness.

The LUFS Meter has been built according to the specifications ITU-R BS.1770-4, EBU R128, EBU R128 s1 v2.0, EBU Tech 3341 v3.0 and EBU Tech 3342 v3.0.

The different loudness values

I	Integrated loudness	The actual loudness. Measured since the last reset.
S	Short-term loudness	The loudness of the past 3 seconds.
M	Momentary loudness	The loudness of the past 400 milliseconds.
LRA	Loudness range	The dynamic range of the music. Measured since the last reset.

LUFS = LKFS = K-weighted loudness units with reference to digital full scale.

Additional information

The EBU Tech 3343 document written by Florian Camerer explains what loudness measurement according to EBU R128 is and provides practical guide-

lines for different applications. Highly recommended. Loudness measurement has also been a cover story in Sound On Sound.

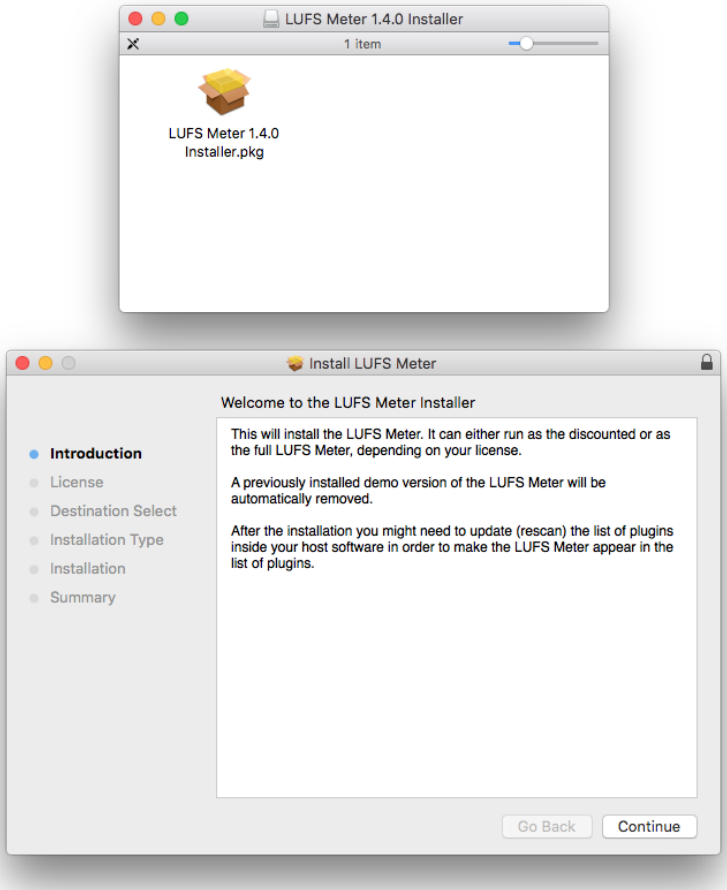
If you are not frightened by technical papers, read Annex 1 (page 2 to 7) of ITU-R BS.1770-4 as well as the
EBU – TECH 3341. This note roughly illustrates how these specifications are implemented in the LUFS Meter.
Additional technical documents are available at ebu.ch.

Installation

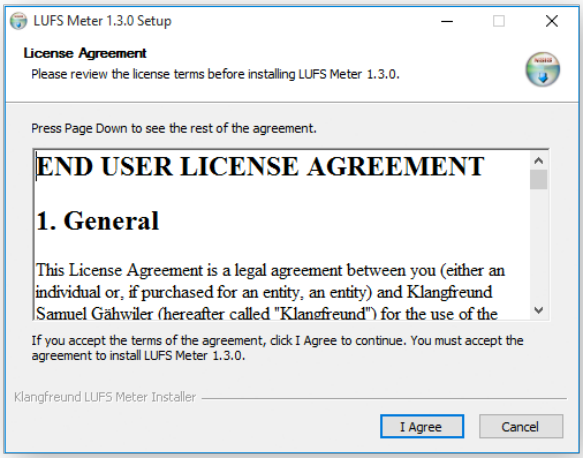
Installation

1. Download the installer for Mac OS X or Windows from the main LUFS Meter page.

2a. On Mac OS X, open the downloaded dmg file. It contains the installer (a pkg file). Run it and follow the instructions.



2b. On Windows, run the downloaded installer and follow the instructions.



3. Open your host (a digital audio workstation or a video editing suite supporting audio plugins) and start using the LUFS Meter. Depending on the host you might need to scan for new plugins before the LUFS Meter appears. Please refer to the manual of your host about how to do that.

Upgrade or downgrade

To upgrade or downgrade (from like the LUFS Meter version 1.3.0 to version 1.4.0 or visa versa), run the installer of the LUFS Meter you want to upgrade or downgrade to. Personal settings and presets won't be altered.

Unlock

Buy

The Discounted or the Full LUFS Meter can be purchased at klangfreund.com.

At the end of the purchase process you'll get an email containing a link to set a password for your newly created account. You need to open this link and set a password in order to be able to download and unlock the LUFS Meter.

The demo version can't be unlocked

If you have the demo version installed, you won't see the big lock symbol when you start the LUFS Meter. In this case, first download the regular LUFS Meter from the LUFS Meter page or from your account and install it before you continue.

Unlock via the Internet

If your audio computer is connected to the Internet, the unlocking can be done from within the LUFS Meter:

1. Click the lock icon.

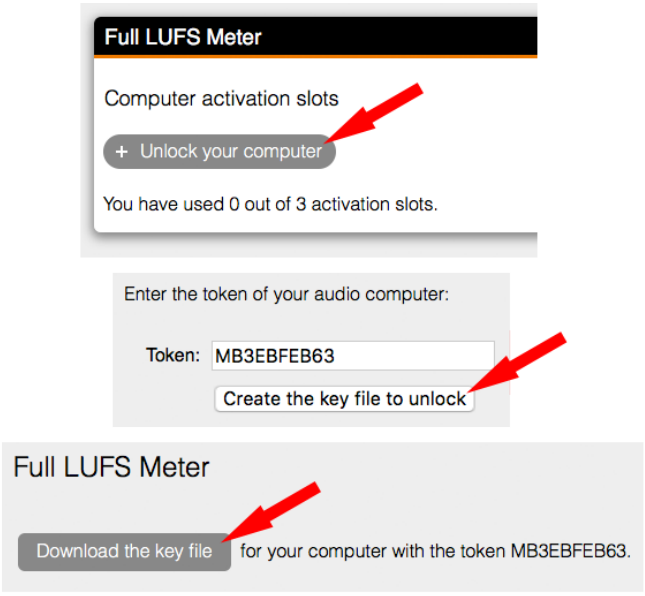
2. - 4. Enter your email address and your password. Click 'Unlock'.

Done.

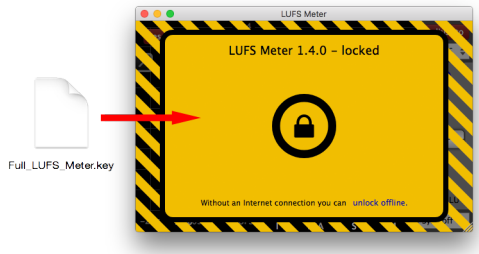
Unlock on an offline computer

Step 1: On your audio computer, open the LUFS Meter and look for the token.
(This token is unique to your computer. It is different on each computer.)

Step 2: To unlock the LUFS Meter a key file is needed which matches this token.
To optain this key file, go to your personal account and follow the illustrated steps.



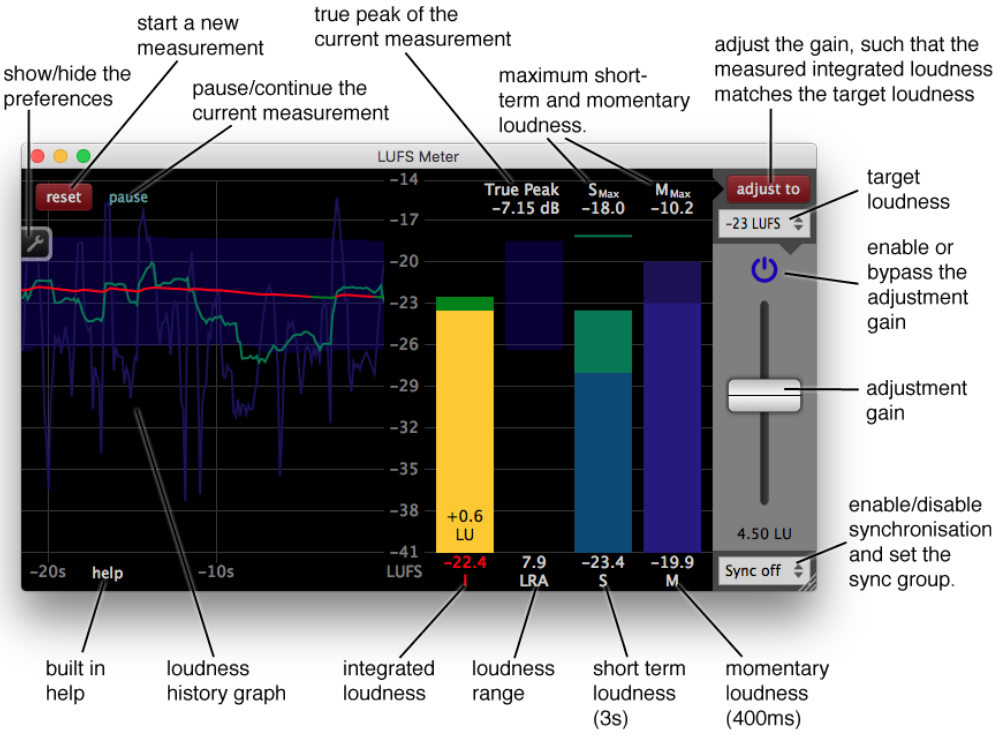
Step 3: Drag and drop the key file over the interface of the LUFS Meter to activate it.



Alternatively you can load the key file via ‘unlock offline’ -> ‘Load key file. . . ’.

Usage

Overview



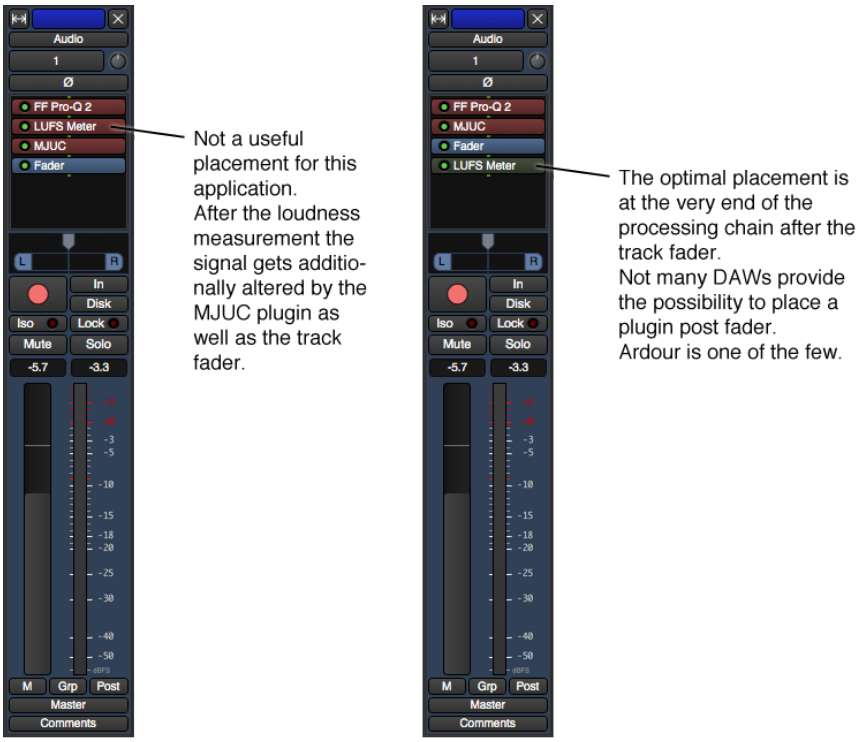
Detailed descriptions of the individual elements are available via the built in help.

Measure the loudness of a single track

Insert the LUFS Meter

The placement of the LUFS Meter is crucial. The loudness gets measured at the position the LUFS Meter is inserted. Everything before the LUFS Meter is included in the measurement, everything after the LUFS Meter isn't. In most usage scenarios you want to include everything and therefore you want to place the LUFS Meter at the end of your plugin chain.

In most use cases the loudness after the track fader is of interest. If your digital audio workstation (DAW) allows the LUFS Meter to be inserted **post fader** (after the fader) thats exactly what you are looking for!



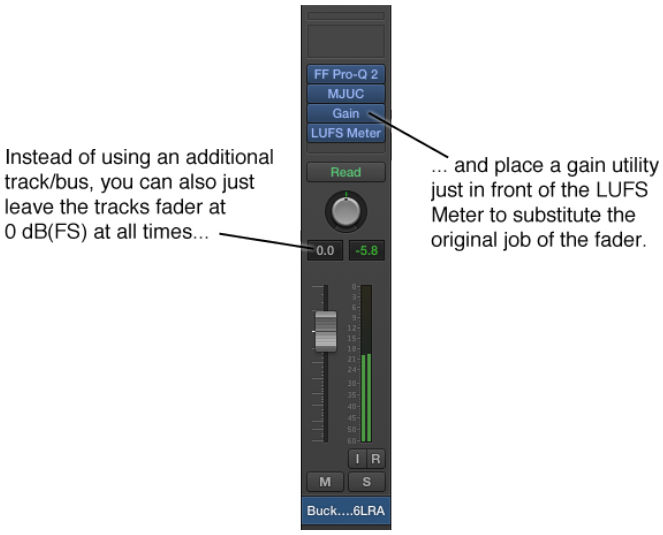
Another DAW allowing plugins to be inserted post fader is Tracktion.

Sadly, only a few DAWs do allow plugins to be inserted post fader. If post fader plugin placement is not supported by your DAW, you can route the output of a track to another track/bus where only the LUFS Meter is inserted. It is important that the fader position of that track/bus stays fixed at 0 dB(FS).

In Reaper, a folder track can be used to place the LUFS Meter after the fader of 'track 1'.
The audio of each track inside a folder track is routed through the folder track. (Click this icon to change a regular track into a folder track.)

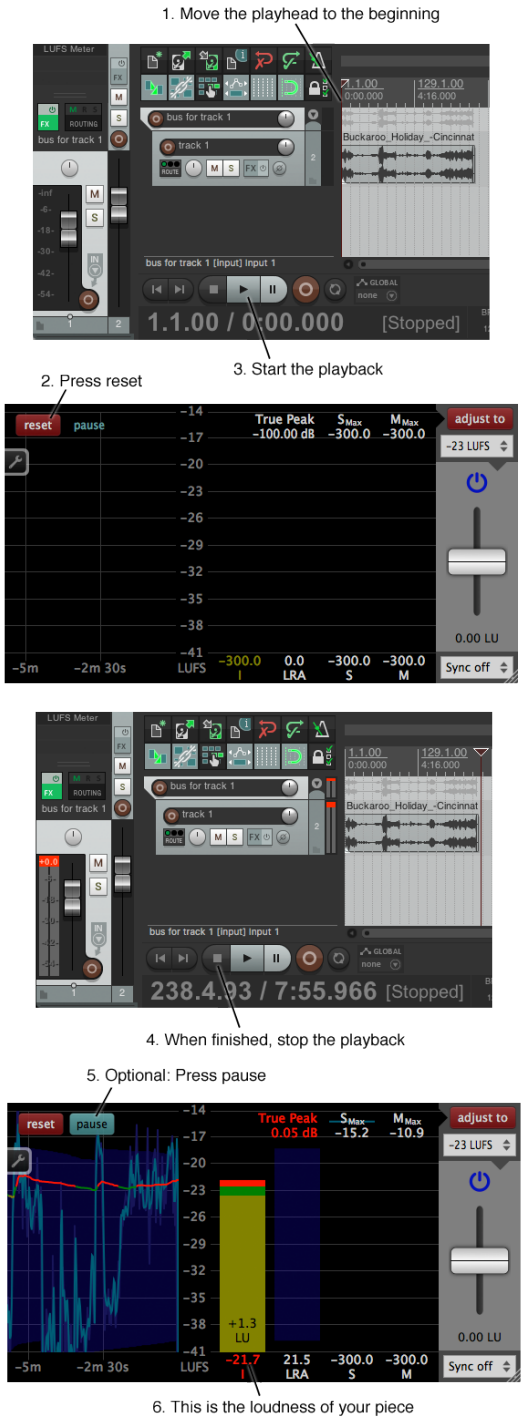
The fader of the folder track needs to stay at 0 dB(FS).

Yet another option for hosts without post fader plugin support is to just leave the tracks fader at 0 dB(FS) and use a gain utility instead to alter and automate the volume.



Measure

The whole piece you want to measure needs to be played back through the LUFS Meter in order to be able to determine the loudness.

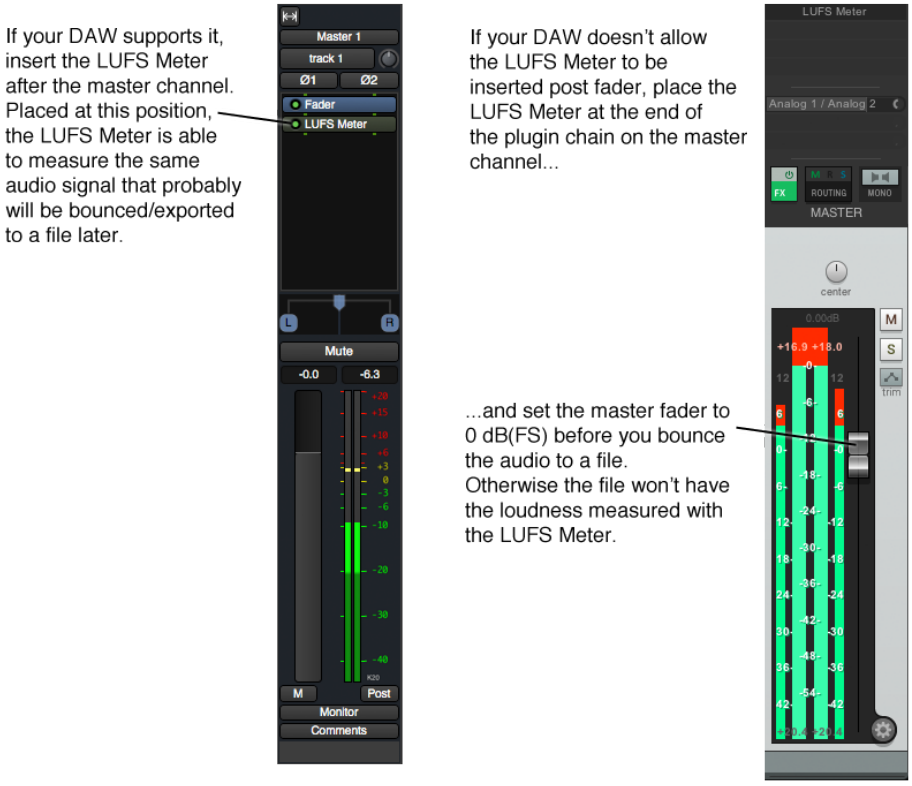

1. Move the playhead to the beginning
LUFS Meter
bus for track 1
track 1
Buckaroo_Holiday_-Cincinnat
bus for track 1 [input] input 1
1.1.00 / 0:00.000
[Stopped]
3. Start the playback
2. Press reset
reset
pause
True Peak
-100.00 dB
S Max
-300.0
M Max
-300.0
adjust to
-23 LUFS
0.00 LU
Sync off
-5m
-2m 30s
LUFS
-300.0
0.0
LRA
-300.0
S
-300.0
M
238.4.93 / 7:55.966
[Stopped]
4. When finished, stop the playback
5. Optional: Press pause
True Peak
0.05 dB
S Max
-15.2
M Max
-10.9
+1.3
LU
-21.7
21.5
6. This is the loudness of your piece

1. Move the playhead of your audio workstation to the beginning.
2. Click the reset button of the LUFS Meter.
   (Silence is not considered by the loudness measurement, so you don't need to hurry to make the next step.)
3. Press play in your audio workstation and play back the entire piece.
4. When finished, stop the playback.
   (Again, the silence that comes after your piece is not taken into account by the measurement, so you don't have to hurry to make the next step.)
5. Optional: You might want to press the pause button. This will stop the measurement and will decrease the CPU usage of the LUFS Meter.
6. Look at the integrated loudness. This is the loudness of your piece.

Measure the loudness of an entire multitrack project

Insert the LUFS Meter

If you are interested in the loudness of an entire project, place the LUFS Meter at the very end of the audio signal path.



Measure

The steps to measure the loudness are exactly the same as in the single track chapter before.

Adjust the loudness

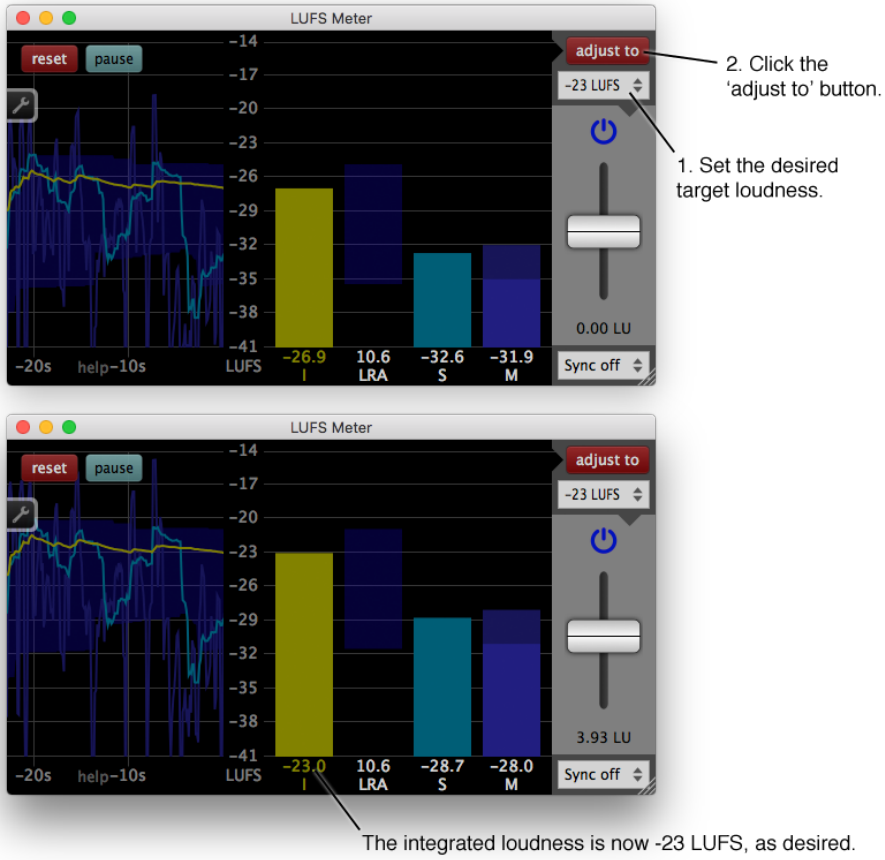
Nowadays it is often needed to deliver audio with a specified loudness. The LUFS Meter is well suited for this task.

Place the LUFS Meter at the end of the processing chain and measure the loudness

Chapter 'How to measure the loudness of an entire multitrack project' describes how to achieve this.

Adjust

Set the desired target loudness and click the adjust to button. Done.



This procedure is also described in a short video tutorial.

Note about LUFS and dB

It is not possible to measure the loudness (According to the specifications of ITU-R BS.1770) with a traditional peak or RMS measurement device. A loudness meter like the LUFS Meter is needed for this task.

Nevertheless, there is a certain connection. A change in volume by x dB in your DAW will result in a change of exactly x LU of the integrated loudness in the LUFS Meter.

Example:
A piece gets measured with the LUFS Meter and it has an integrated loudness of -26 LUFS. Now a gain plugin is inserted in front of the LUFS Meter and it is set to +3 dB. For a second time the loudness gets measured with the LUFS Meter. This time the integrated loudness is -23 LUFS (-26 LUFS + 3 LU).

Create a faders up mix

Introduction

Getting started on a new mix can be quite time consuming, especially if the project contains a lot of tracks.

Some mix engineers begin with an initial **faders up mix** where all tracks are set to the same loudness before going deep into the mixing session.

Different ways exist to achieve such a faders up mix. One can create it manually by listening and adjusting the levels of the individual tracks until everything sounds equally loud. Another method is to listen to each track in isolation and adjust it's level such that it aligns with a reference pink noise signal.

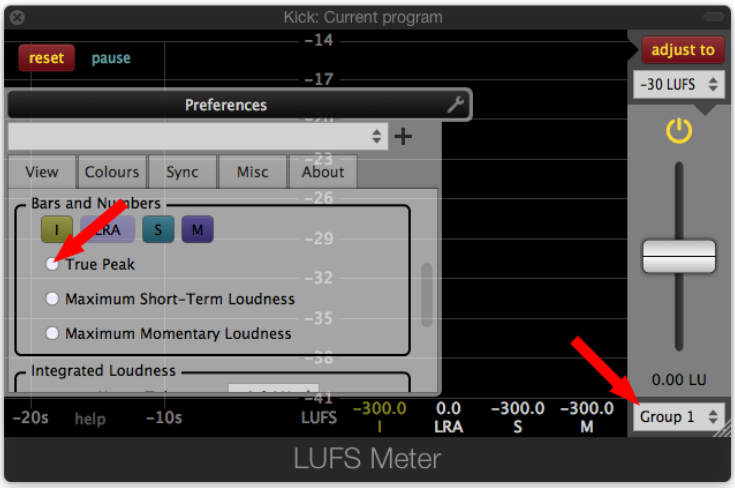
The LUFS Meter provides a third method, based on its unique synchronization feature. This is by far the fastest way to create a faders up mix.

This procedure is also described in a video tutorial.

Step 1. Add the first LUFS Meter

A LUFS Meter will be added to each track. Before doing so, only add one LUFS Meter to your first track. If this track already contains plugins, add

the LUFS Meter after the last plugin. In the LUFS Meter, turn off the true peak measurement to save processing power. True peak is not needed in this application. Also enable synchronization by choosing a sync group.



Step 2. Copy this LUFS Meter to the other tracks

Copy this LUFS Meter to the remaining tracks. Insert it after the last plugin on each track. Since you copy it, all LUFS Meters do belong to the same sync group.

Step 3. Measure the entire project

Open one of the LUFS Meters and push the reset button. Thanks to the enabled synchronization all other LUFS Meters will also reset.

Play the project from start to finish, such that each LUFS Meter can measure the audio of its track.

Step 4. Adjust all tracks at once

Press the 'adjust to' button on one LUFS Meter. All other LUFS Meters will also adjust their track, thanks to the synchronization. **The faders up mix is now created**.

To turn off the measurement of all LUFS Meters, press the pause button. Now the LUFS Meters operate as simple gain plugins with a barely noticable hit on your processor.

If not done yet, don't forget to set all track faders to the same value.

Readjust while mixing

After the faders up mix you most likely will use the track faders to find a sweet loudness balance between the different tracks. Lets call this state SLB. This SLB wont last long. As soon as the dynamic of a track gets changed or if some equalization is applied, the tracks loudness will also change and the SLB is destroyed.
If only one track was altered, manually adjusting the track fader (or a gain plugin somewhere before the LUFS Meter) is probably the fastest way to get back to the SLB. But if multiple tracks got changed it might be faster to reinvoke the LUFS Meters and to let them do the adjustment. To do so, turn off the pause, push the reset button, play back the entire project and click the 'adjust to' button again. Because the track faders are still in the SLB position, this will result in the SLB again.

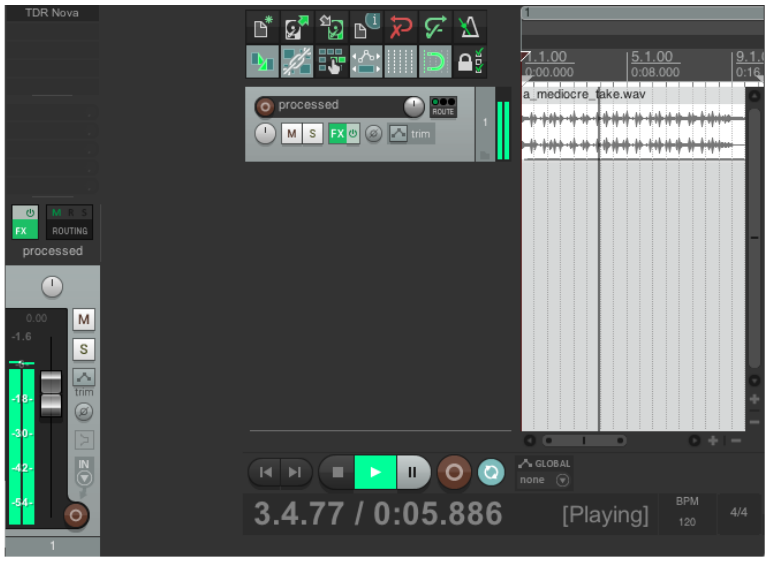
Judge effects effectively

If not in a hurry, an audio engineer can easily spend hours building and tweaking effect chains on a single audio track to achieve a mind blowing sonic masterpiece (Well, in reality it is more often to fix a poor performance and inadequat recording..). During this process it is essential to continuously compare the unprocessed (original) audio with the processed signal (after the effects). No one wants to get a worse sounding result out of his effects.

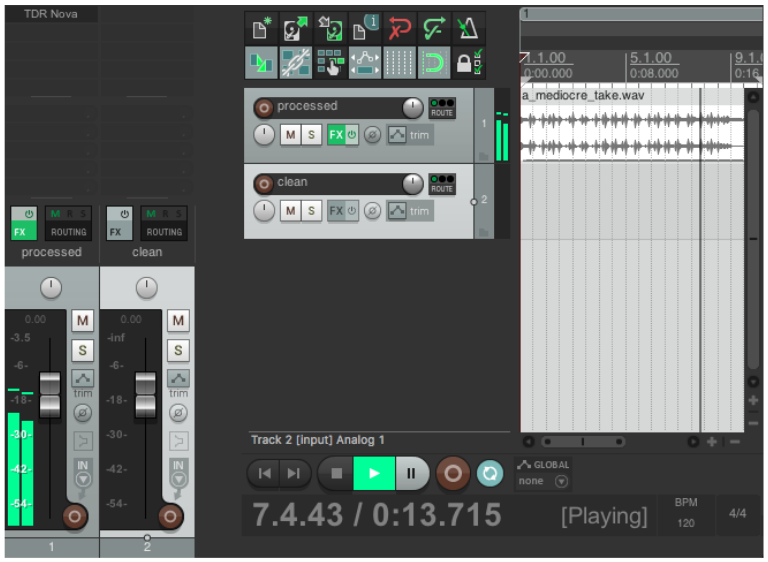
But there's a catch. If an effect slightly degrades the audio quality, but at the same time increases the loudness, it is perceived as better sounding by the human hearing. It is a psychoacoustic effect one needs to take into account. There exists a countermeasure to not be fooled: Adjust the unprocessed and the processed signal to the same loudness before performing the critical listening camparison. The LUFS Meter comes in handy for this task.

. . . in Reaper

For the sake of simplicity, the project shown here only contains one track with one effect.

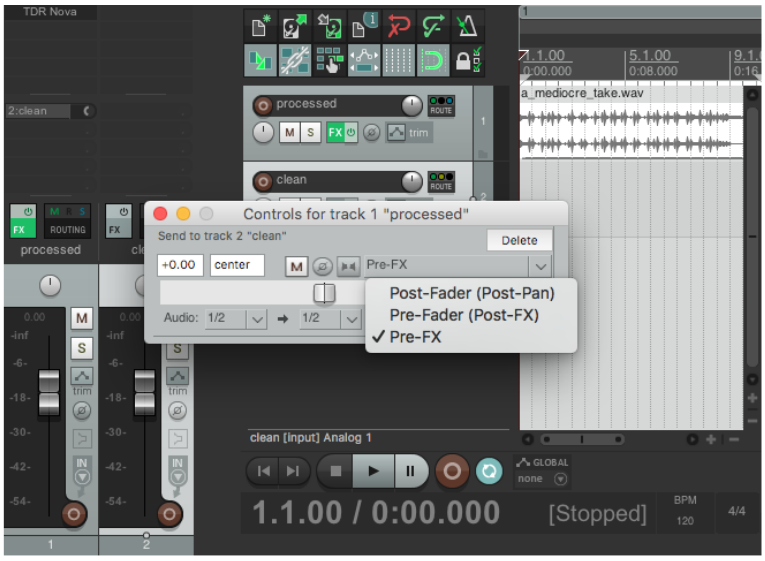


Add a second track by double clicking below the current track. (I named it 'clean'.)

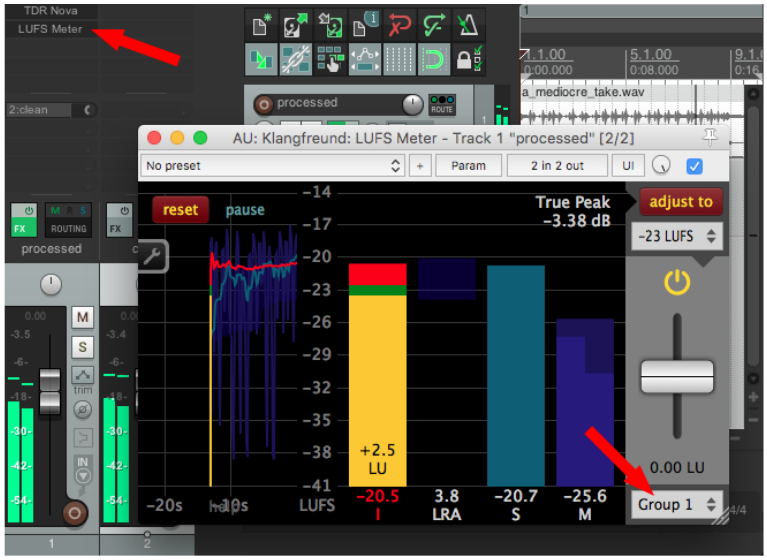


Route the audio of the first track to the second by grabbing the route icon of the first track and drop it over the second track. A pop-up window appears where you can choose at which position of the first track the audio should

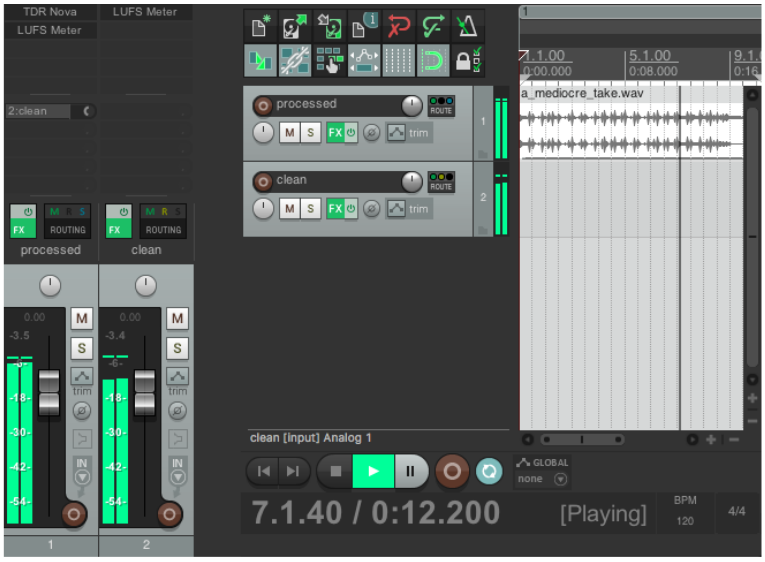
be taken. Choose 'Pre-FX', such that the second track will receive the unprocessed audio.



Close this pop-up window and add a LUFS Meter to your first track. It needs to be the last effect on that track for this application. Enable the synchronization of the LUFS Meter by choosing a sync group.



Drag and drop the LUFS Meter from the first track to the second track. This will create a copy of the LUFS Meter with the same settings as the first one (-> Both belong to the same sync group).



The first LUFS Meter now receives the processed audio (by the TDR Nova plugin) and the second LUFS Meter receives the unprocessed audio.

Measure and adjust the loudness with one of these LUFS Meters (the loudness target for this application can be chosen to personal taste). Thanks to the enabled sync feature, the first as well as the second track are now loudness adjusted. Or stated differently, the clean as well as the processed track are now equally loud. To hear both tracks at an equal loudness, make sure that the channel fader of the second track is at the exact same position as the first one.

Now you are able to compare the processed and the clean signal by listening exclusively to each of these two tracks using the solo buttons (Hint: Click the S button while holding the Command and the Alt key. This will un-solo every other previously toggled solo button).

There is one caveat in Reaper. If you solo the first track, you will also hear the second one, even if the solo button of the second one is not lit. To avoid this, click the mute button of the second track.

This is how to listen to the processed signal:

And this is how to listen to the clean signal:

. . . in all hosts

Instead of routing the signal from the first track to the second track, one can simply copy the first track with all the contained regions to a second track. Then remove the effect(s) you wan't to judge from the second track and procede as described above.

Comply with a high loudness target

The original idea of using a low program loudness target like -23 LUFS is that there is plenty of headroom available, such that a compressor or a limiter on the master bus is only needed in rare circumstances for the sake of compliance.

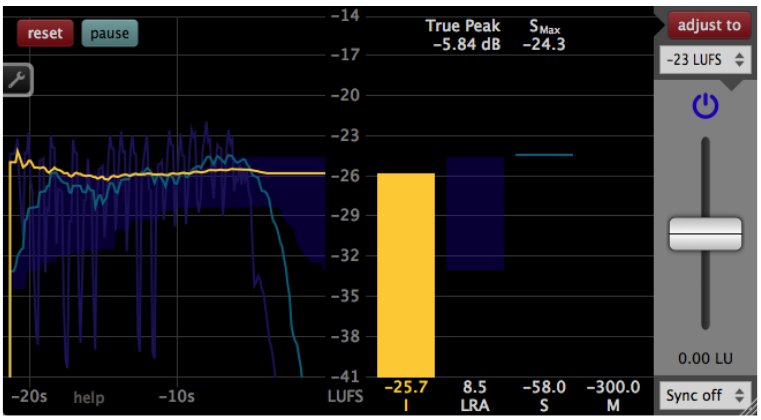
But well. . . some clients require to deliver loudness adjusted material with a much higher program loudness, for example -16 LUFS. A lot of original material adjusted to such a high loudness will have a true peak exeeding 0 dB(TP) which will result in audible clipping. This section describes how

to use the LUFS Meter in conjunction with a limiter to reach a program loudness of -16 LUFS and a true peak below -1 dB(TP).

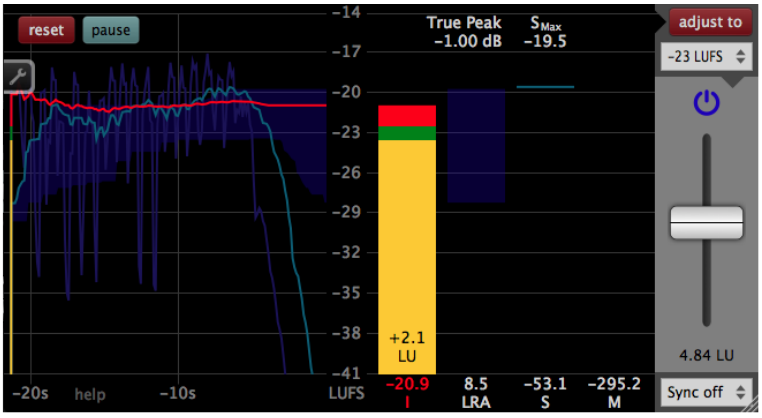
The original material

To follow along you can download the drumloop used in this example.

The LUFS Meter reveals that this drumloop has a program loudness (= integrated loudness) of -25.7 LUFS and a true peak of -5.84 dB(TP).

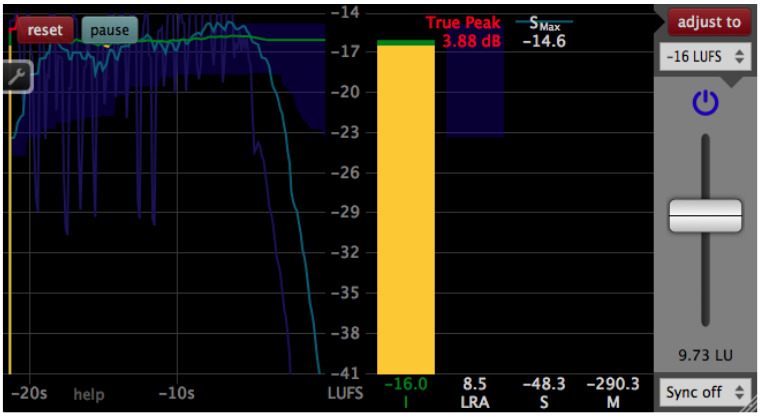


If it is requested to deliver this piece of audio with a program loudness below -16 LUFS and a true peak below -1 dB(TP) this is easy to achieve. Just increase the gain of the LUFS Meter until the first of the two values reaches its specified limit. In this example, it's the true peak.



Limiting

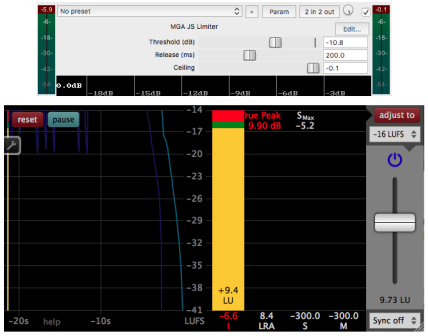
If it is requested to deliver this piece of audio with a program loudness of EXACTLY -16 LUFS and a true peak below -1 dB(TP) this isn't as streight forward as before. By choosing the loudness target '-16 LUFS' at the top right and clicking the 'adjust to' button...



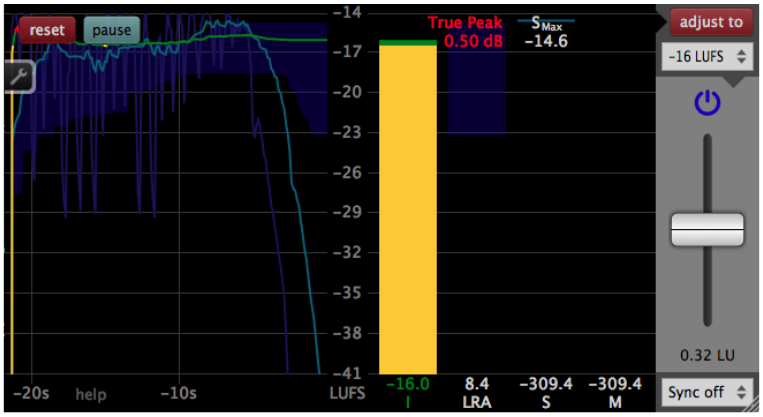
...it is now clearly visible that this requirement can't be fulfilled without changing the audio. The true peak of 3.88 dB(TP) is way to high. We need to alter the dynamics. This can be done by e.g. surgically edit the volume automation, or by applying an effect like a compressor or a limiter. The limiter FabFilter Pro-L is quite good for this task. Nevertheless, the MGA JS Limiter included in Reaper is used to demonstrate how to do this on a budget.

Before adding and setting up the parameters of the limiter, take a look at the current readings of the LUFS Meter. A gain of 9.73 LU has been applied. And we would like to get a true peak of lower or equal to -1.00 dB(TP). This means that we need the audio before the LUFS Meter to have a true peak of -1.00 -9.73 = -10.73 dB(TP) or less.

Now it's time to add the MGA limiter in front of the LUFS Meter. Set its threshold to -10.8, reset the LUFS Meter and start the playback again. This gets loud, so turn down the main output before starting the playback.



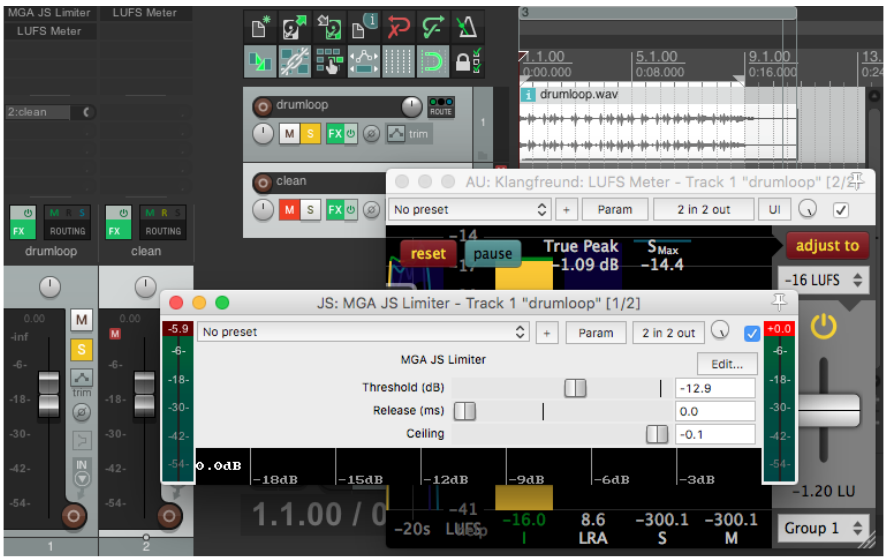
By inspecting the true peak value it appears at first glance that the limiter hasn't worked at all. The true peak is even higher then before. Looking at the program loudness of -6.6 LUFS it gets clear what happened. The MGA limiter applies a make-up gain after processing. To cope with this new make-up gain a single click to the LUFS Meters 'adjust to' button is sufficient.



With a program loudness of -16 LUFS, the true peak is now at 0.5 dB(TP). Still not what we want. Has our calculation for the limiters threshold been wrong? One reason for this mismatch is that the MGA limiter only considers the sample peaks and not the (true) peaks in between the samples. But it also seems to be the case that this limiter might not be totally accurate. Some more trials reveal that a threshold of -14.4 dB yields to a satisfying result for this audio file.

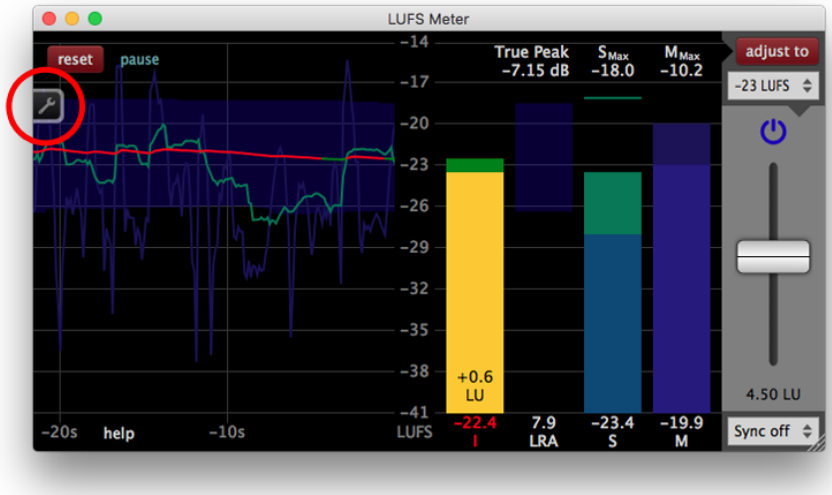
Even though it finally complies to the desired specification, it is strongly recommended to always tweak the parameters of a limiter until it sounds as pleasing as possible for the given material. To do so, use the technique described in the previous chapter about comparing effects: Send the unprocessed signal (before the limiter) to a second track and add a LUFS Meter to it. Sync this LUFS Meter with the LUFS Meter already in use and set the target loudness to -16 LUFS as well.

For this specific drum loop, the shortest possible release time sounded best to my ears. But bear in mind that this is not a general rule that fits all audio files equally well. An audio podcast containing only talk most likely wont sound good with such a fast release time.



Settings and presets

Click the wrench symbol on the left to show or hide the preferences panel. It contains all settings and presets.

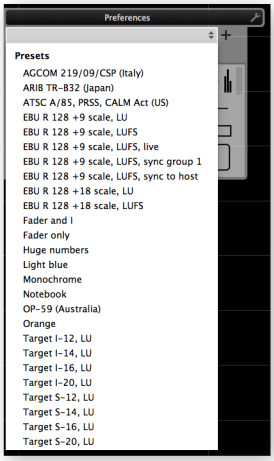


Presets

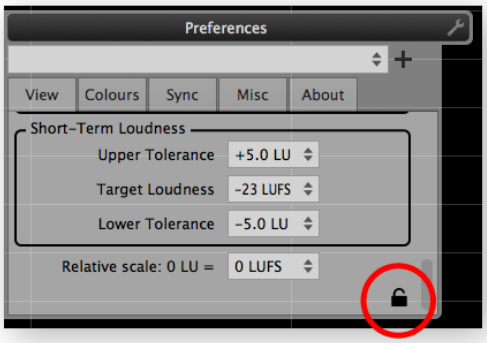
A preset is a snapshot of settings. It also includes the size of the plugin window. There are no additional hidden settings stored in a preset.

Load a preset

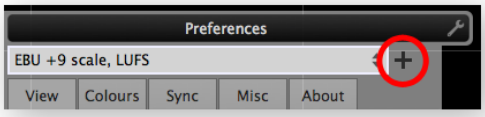
To load a preset, choose one from the preset list at the top of the preferences panel.



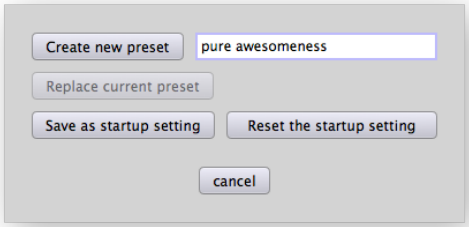
Each settings-tab has a little padlock icon at the bottom. If the padlock is closed, the settings of that tab won't be changed when loading a new preset. This makes it possible to e.g. keep the current sizes of the elements but change the colours when a preset is loaded.



Save a preset



After pushing the '+' button on the right of the preset list, a dialog window appears.

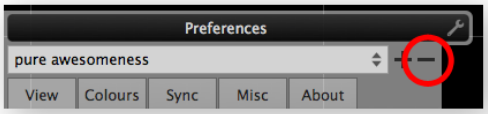


Name the preset and click the 'Create new preset' button if you would like to save it. Each user created preset is stored as a separate file to disk. It can be found at

- Mac OS X:
- /Users/<your user name>/Music/Audio Music Apps/Klangfreund/LUFSMeter/UserPresets/
- Windows:
- C:\Users\<your user name>\AppData\Roaming\Klangfreund\LUFSMeter\UserPresets\

The save dialog window also offers to replace a preset. Bear in mind that factory presets can't be replaced, they are write protected.
The current settings can also be set to be used as the startup settings. Each time the LUFS Meter gets loaded, these settings will be used.

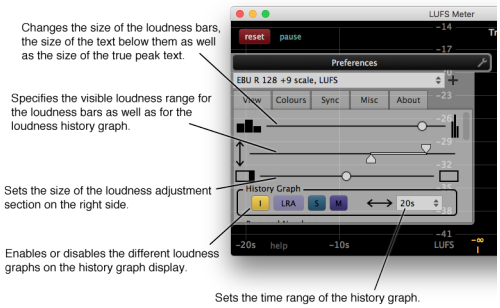
Delete a preset

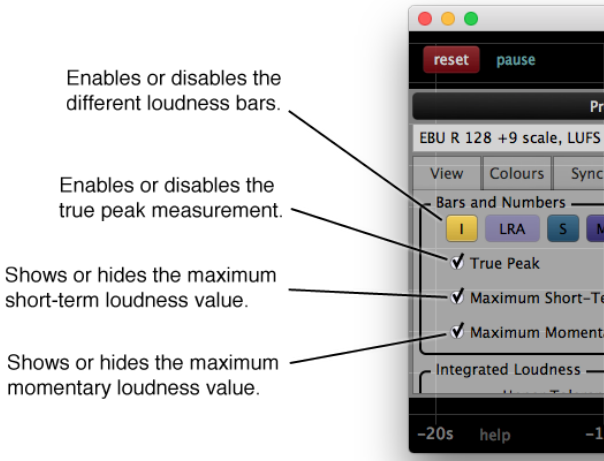


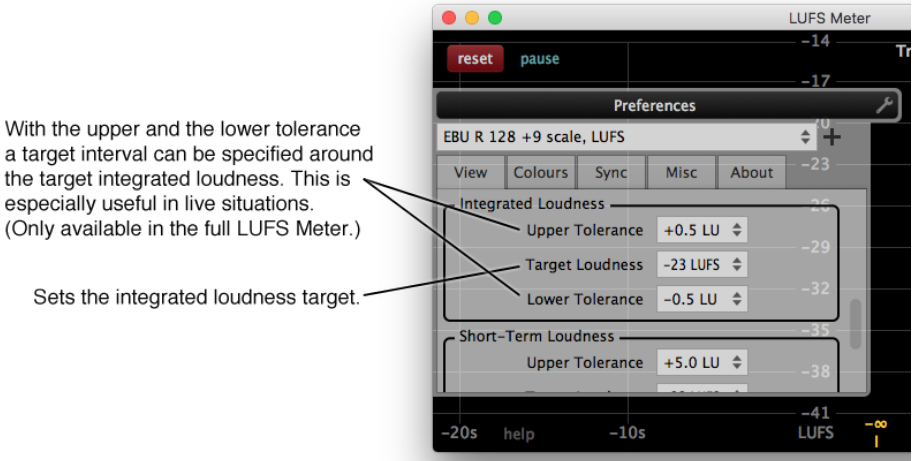
To delete a preset push the '-' button, located next to the '+' button. This button won't be displayed on factory presets because they can't be deleted.

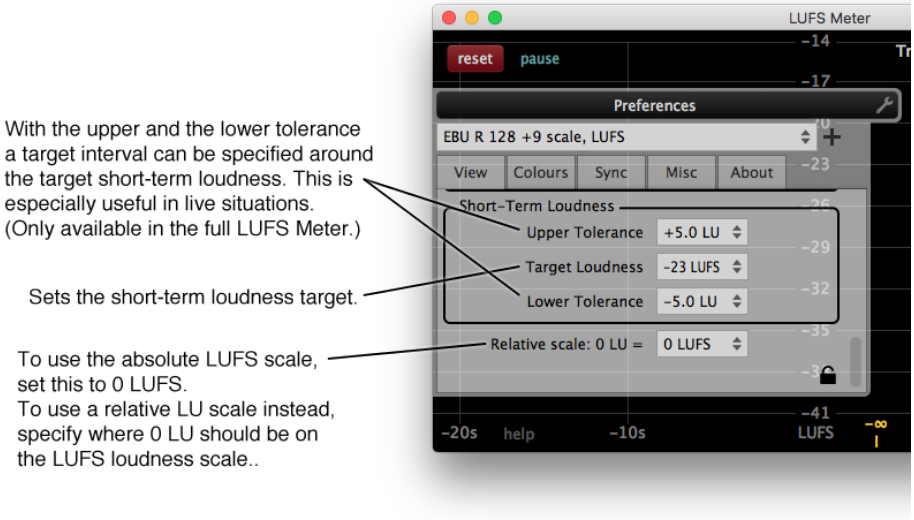
A confirmation dialog will appear, where the intention to delete the preset must be confirmed. The file of this preset will be deleted from the disk.

View section



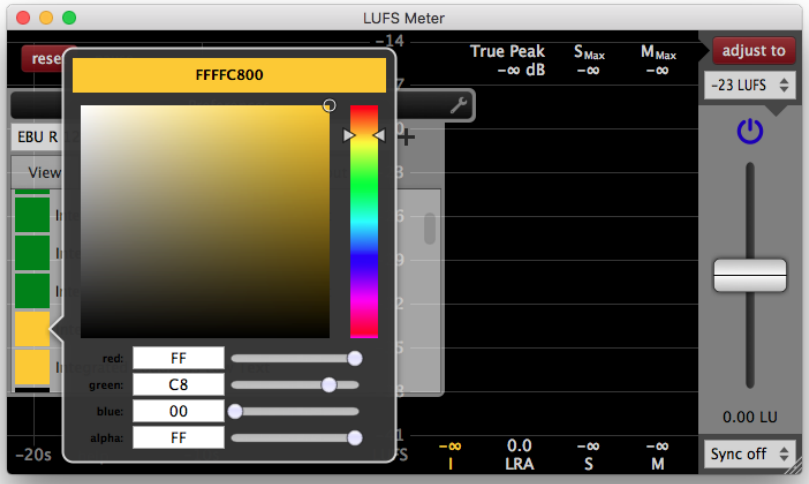




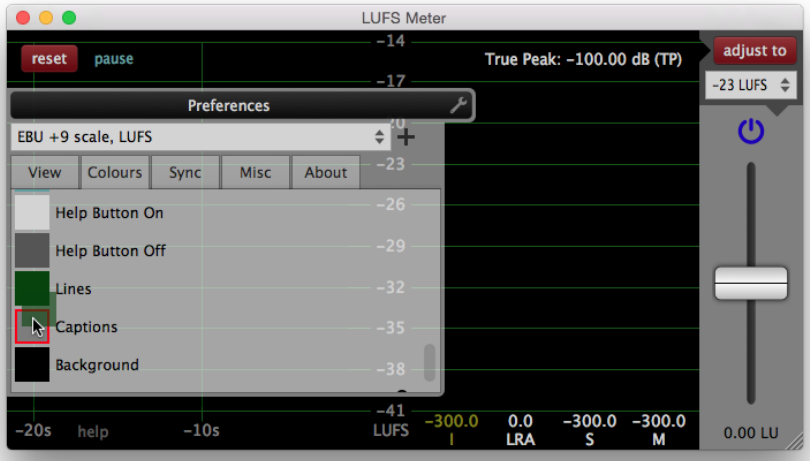


Colours section

On the colours tab you can customize the colours used in the LUFS Meter. To change the colour of an item click the coloured square left to the items description. A colour selector will appear.



To use one colour on multiple items, a coloured square can be drag and dropped over another one, to copy its colour over.

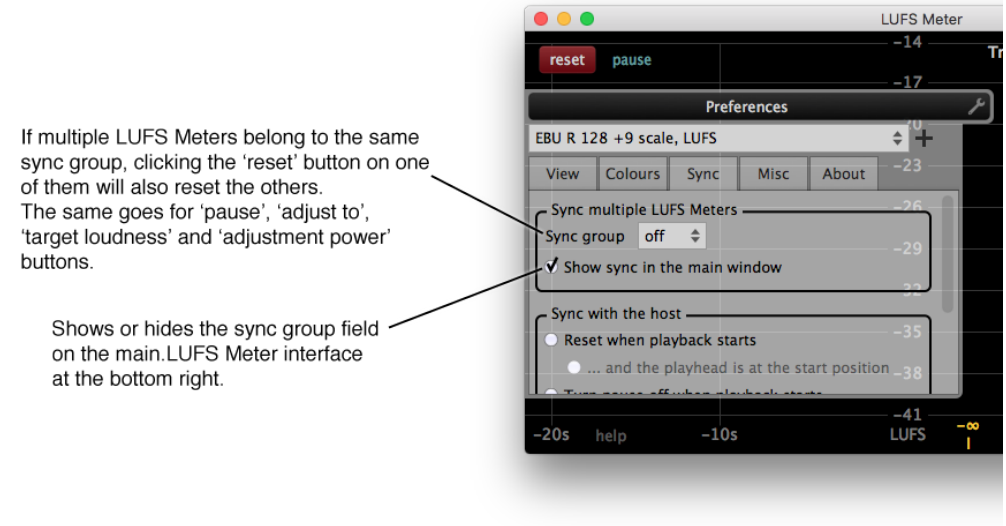


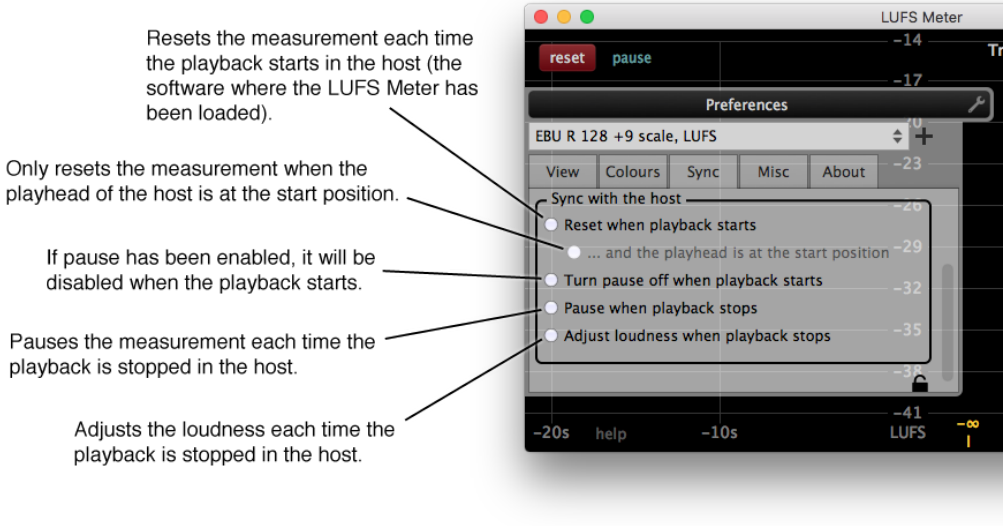
Like in the view section, the colour section also has a padlock icon at the bottom. If engaged, the current colour settings won't be altered if a preset gets loaded.

Hide the help button

If you turn the alpha value of the 'Help button off' colour down to zero, the help button won't be visible anymore if it is toggled off. Of course you can also apply this technique to other elements of the LUFS Meter.

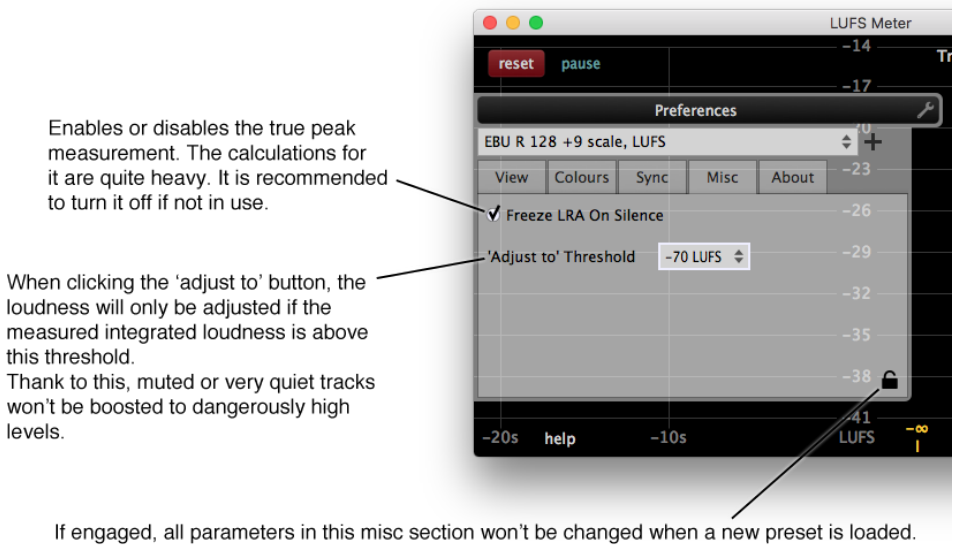
Sync section





The sync section has a padlock icon at the bottom as well. If engaged, the current sync settings won't be altered if a preset gets loaded.

Misc section



About section

The about section displays the current version of the LUFS Meter, the update check settings as well as a button to open the unlock dialog.

Appendix

Accuracy of the LUFS Meter

To verify the accuracy of a loudness meter, the ITU and the EBU provide test files. The LUFS Meter passes all these tests. The results are available here.

What to do on a system change / upgrade

This section describes how to precede on a hardware upgrade, a switch to another computer or on a complete reinstallation of the whole operating system.

- A deactivation of the LUFS Meter before the change is not needed.
- On the new system the LUFS Meter needs to get unlocked again.

That's all. If this is repeated a certain number of times (depending on the number of licenses you own), you will run out of unlock slots. To reclaim unlock slots, deactivate old unlock slots you no longer need in your personal account.

Troubleshooting

Pro Tools AAE error -7106

After upgrading the LUFS Meter it can happen that you can't open the stereo LUFS Meter in Pro Tools anymore. Instead of the user interface, a pop up window appers showing 'AAE error -7106'. The origin of this issue lies within Pro Tools. Klangfreund works closely with Avid to help improve this in a future version of Pro Tools.

If this happens to you, there is a procedure to get rid of this:

- Close Pro Tools.
- Remove the AAX version of the LUFS Meter: On Windows, run the uninstaller. On OS X, manually remove the aaxplugin file.
- Open Pro Tools, verify that there is no LUFS Meter available and close Pro Tools.
- Install the LUFS Meter again.

Final Cut Pro X

Final Cut Pro X together with audio plugins is more sturdy if audio skimming is turned off. This also holds true for the LUFS Meter.

Audacity sample rate anomalies

Audacity (version 2.1.2 on OS X 10.11.2) has an issue concerning the communication of the sample rate to VST plugins. It reports a sample rate of 44.1 kHz to a plugin, disregarding files or projects with another sample rate. So if you analyse the loudness of a file with a sample rate other then 44.1 kHz, the measurement will be wrong. No matter if you use the LUFS Meter or any other meter.
This affects almost all other VST plugins as well (EQs, delays, reverb, compressors with time parameters), since a wrongly reported sample rate leads to errors in the time as well as in the frequency domain.

After initial talks, Klangfreund has provided the developers of Audacity with a custom made debugging plugin to resolve this issue. A fix is not yet available.

At the time being, Klangfreund recommends to not use Audacity.

Files

Mac OS X

If all plugin formats have been selected in the installer, these files got created:

- /Library/Application Support/Avid/Audio/Plug-Ins/LUFSMeter.aaxplugin
- /Library/Audio/Plug-Ins/Components/LUFSMeter.component
- /Library/Audio/Plug-Ins/VST/LUFSMeter.vst
- /Library/Audio/Plug-Ins/VST3/LUFSMeter.vst3

Global settings (including the activation) for the LUFS Meter are stored in

- /Users/<your user name>/Music/Audio Music Apps/ Klangfreund/LUFSMeter/LUFSMeter.settings

Presets created by the user are stored in the folder

- /Users/<your user name>/Music/Audio Music Apps/ Klangfreund/LUFSMeter/UserPresets/

This folder gets created when the first preset is saved by the user. Each preset is stored in a separate XML file. The factory presets are not stored as files, they are contained in the plugin.

Windows

In contrast to Mac OS X, the 32 and 64 bit VST plugin formats don't have a well defined file location on Windows. That's why you can choose the location for them in the installer. To help find these locations later, the installer saves a list of all created files to

- C:\Program Files (x86)\LUFSMeter\pluginLocations.txt

If you haven't altered the pathes during installation, these files got installed to

- C:\Program Files\Common Files\Avid\Audio\Plug-Ins\LUFSMeter.aaxplugin
- C:\Program Files (x86)\Steinberg\VstPlugins\LUFSMeter.dll
- C:\Program Files\Steinberg\VstPlugins\LUFSMeter (64 bit).dll
- C:\Program Files (x86)\Common Files\VST3\LUFSMeter.vst3
- C:\Program Files\Common Files\VST3\LUFSMeter (64 bit).vst3

Global settings (including the activation) for the LUFS Meter are stored in

- C:\Users\<your user name>\AppData\Roaming\Klangfreund\LUFSMeter\LUFSMeter.settings

Presets created by the user are stored in the folder

- C:\Users\<your user name>\AppData\Roaming\Klangfreund\LUFSMeter\UserPresets\

This folder gets created when the first preset is saved by the user. Each preset is stored in a separate XML file. The factory presets are not stored as files, they are contained in the plugin.

Uninstall

Mac OS X

OS X does not provide an uninstall mechanism. You have to manually delete the LUFS Meter files.

Windows

Run the uninstaller. Either directly from

- C:\Program Files (x86)\LUFSMeter\uninstaller.exe

or select the LUFS Meter in the Control Panel -> Programs and Features.

About this manual

This manual describes version 1.4.0 of the LUFS Meter.