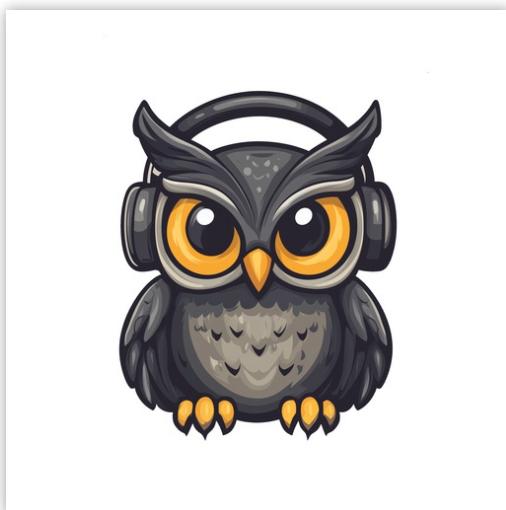


APU Loudness Meter



User Manual

v4.4.4

Table of Contents

Table of Contents	2
1. Introduction	4
2. Parameters	4
2.1. Meters	4
2.1.1. Presets	5
2.1.2. Loudness type	5
2.1.3. RMS window	5
2.1.4. Momentary window	5
2.1.5. Short-term window	5
2.1.6. Output type	6
2.1.7. Visualization	6
2.1.8. Raster type	6
2.1.9. Raster orientation	6
2.1.10. Live monitoring	6
2.1.11. Reset meters	6
2.1.12. Open file	6
2.1.13. Analyze all	7
2.1.14. Target range	7
2.1.15. Learn target range	7
2.1.16. Target range presets	7
2.2. Loudness	8
2.2.1. Adaptive startup	8
2.2.2. Adaptive edges	8
2.2.3. Adaptive type	8
2.2.4. Adaptive threshold	8
2.3. Visualization	9
2.3.1. Auto range	9
2.3.2. Visual range presets	9
2.3.3. Loudness range	9
2.3.4. Snapshots	10
2.3.5. Layout options	10
2.3.6. Layout source mode	10
2.3.7. Layout target mode	11
2.3.8. Layout output mode	11
2.3.9. Delta field type	11
2.3.10. Bits per pixel	11
2.3.11. Milk Mode	11
2.3.12. Bucket size	11
2.3.13. Histogram hold	11
2.3.14. Delta X/Y/T	11
2.3.15. Delta field	12
2.3.16. Shader params	12
2.3.17. Show thresholds	12
2.3.18. Panel params	12
2.3.19. History length	12
2.3.20. Show statistics	12
2.3.21. Show axis labels	12
2.3.22. Show axis lines	12
2.3.23. Show param context	13
2.4. Theme	13
2.4.1. Theme presets	14
2.4.2. Source color	14
2.4.3. Normal color	14
2.4.4. Target color	14
2.4.5. Output color	15
2.4.6. Textures	15
2.5. Settings	15
2.5.1. BPM	15
2.5.2. Host BPM	15
2.5.3. Velocity sensitive knobs	16
2.5.4. Load preset visuals	16
2.5.5. Load preset ranges	16
2.5.6. UI Scaling	16
2.5.7. Dark mode	16
2.5.8. Blocksize	16
2.5.9. Delay compensation	16
2.6. Update	16
2.7. About	16
3. Glossary	17
3.1. Range sliders	17

3.2. History	17
3.3. Histogram	17
3.4. Source	17
3.5. Target	17
3.6. Output	17
4. Credits	18
4.1. MIT License (libebur128)	18
4.2. MIT License (melatonin_blur)	18

1. Introduction

[APU Loudness Meter](#) is a modern loudness analysis plug-in released by [APU Software, LLC](#). This plug-in is designed to provide both real-time monitoring and full histogram analysis of your audio's loudness over time. Here you can read about the different features and parameters available with the meter.

2. Parameters

This software supports a variety of parameters, most of which can be adjusted in real-time. This section provides an overview of each parameter, with each subsection detailing the parameters for the associated tab in the user interface. From within the user interface, you can also hover the mouse over a slider, combo-box, or checkbox to see a popup description of the parameter.

2.1. Meters



The meters tab contains configuration, visualization, and statistics for loudness analysis. This section details each of the individual parameters and components.

2.1.1. Presets

Loudness Meter's presets combo-box contains a collection of basic presets.

You can configure whether or not to [load preset visuals](#) when switching between presets, and you can switch between loading dark or light themes through the [dark mode](#) parameter.

Currently, the following presets are available ("Full Reset" restores all default parameter values):

- Full Reset
- Live Monitoring - Standard Reference
- Live Monitoring - Apple
- Live Monitoring - Deezer
- Live Monitoring - Spotify/Tidal/YouTube
- Live Monitoring - Spotify Loud
- Full Histogram - Standard Reference
- Full Histogram - Apple
- Full Histogram - Deezer
- Full Histogram - Spotify/Tidal/YouTube
- Full Histogram - Spotify Loud
- Visualization - History (Spiral)
- Visualization - History (Swirl)
- Visualization - History (Polar)
- Visualization - History (Wave)

2.1.2. Loudness type

The loudness type combo-box and channel-link button allow you to configure the type of loudness measurement to use. Each loudness type supports channel-split or channel-linked processing. Channel-split treats each channel independently, while channel-linked integrates across all channels.

Three of the supported loudness types use a popular modern measurement standard for perceived loudness called [LUFS](#). These loudness types are momentary (400ms window), short-term (3s window) and Integrated (infinite window).

There are also two [peak](#) loudness types (True Peak and Peak) as well as traditional [RMS](#). True Peak is an improvement on [peak](#) which takes into consideration waveform behavior between samples, which allows it to properly respond to inter-sample peaks. Peak mode loudness types use a [blocksize](#) window.

Integrated loudness type window can be reset by pressing the reset button.

2.1.3. RMS window

The RMS window parameter allows you to adjust the duration of the RMS window in milliseconds. Lower window durations respond more quickly to changes in loudness, while higher window durations provide a more stable loudness measurement. The RMS window is used by the RMS [loudness type](#).

2.1.4. Momentary window

The momentary window parameter allows you to adjust the duration of the momentary window in milliseconds. Lower window durations respond more quickly to changes in loudness, while higher window durations provide a more stable loudness measurement. The momentary window is used by the Momentary [loudness type](#).

2.1.5. Short-term window

The short-term window parameter allows you to adjust the duration of the short-term window in milliseconds. Lower window durations respond more quickly to changes in loudness, while higher window durations provide a more stable loudness measurement. The short-term window is used by the Short-term [loudness type](#).

2.1.6. Output type

The output type combo-box allows you to configure which type of metering measurement is displayed by the visualizer. These measurements are displayed using the current [output](#) color.

Integrated output type takes into consideration the full history of audio since last reset, and is implemented according to the [LUFS](#) specification.

History average, history peak, and history min are based on the [history](#) buffer, whose length is configurable from the [visualization](#) tab. This allows you to continuously analyze any length of time supported by the [history length](#) parameter.

Global average, global peak, and global min analyze all loudness measurements since the last reset.

2.1.7. Visualization

The visualization component displays a continuously evolving real-time view of your [source](#) and [output](#) loudness over time. There are currently two main types of visualizations: [history](#) and [histogram](#). [History](#) displays a rolling window of the most recent history of loudness samples. [Histogram](#) divides this history up into buckets and displays the relative proportion of each bucket in real-time.

You can hover the mouse over a bucket to see the loudness range the bucket corresponds to.

The visualization component also displays the current [target range](#), allowing you to precisely target this range based on the dynamics of the audio. Detailed visualization settings can be adjusted from the [visualization](#) tab, with some features also available by right clicking on the visualization component.

You can double-click the visualization component to zoom in and hide everything else.

2.1.8. Raster type

The raster type parameter allows you to specify the type of raster visualization. You can select between [history](#) and [histogram](#) views, with either loudness or delta values. Loudness values match the currently selected [loudness type](#) while delta values take the difference between [target](#) and [output](#) (meter) loudness.

2.1.9. Raster orientation

The raster orientation parameter allows you to specify the rotation of the raster visualization. You can select between horizontal and vertical orientations.

2.1.10. Live monitoring

The live monitoring option enables continuous loudness measurements and visualization. When disabled, only arrangement/timeline playback will be monitored. This can help ensure the accuracy of loudness measurements and statistics.

2.1.11. Reset meters

The reset button resets [history](#) and [histogram](#) visualizations, along with any accumulated statistics data.

2.1.12. Open file

The “Open file ...” button allows you to perform analysis on any supported audio file. This will also clear all previous [history](#) and [histogram](#) visualizations, along with any accumulated statistics data.

This feature automatically switches to [histogram](#) view after analyzing the file, which allows you to quickly view the dynamic range of the audio material. Statistics will reflect the contents of the audio as well.

After opening an audio file, press the “Close file” button to return to live monitoring.

2.1.13. Analyze all

The analyze all parameter allows you to specify whether analysis should include all loudness types or only the currently selected loudness type. This allows you to save time when processing long audio files by only analyzing the loudness type you're interested in.

2.1.14. Target range

The target range parameter allows you to specify a min and max loudness value for the target range, displayed in the visualization component as an overlay.

This option will only be visible if the [show thresholds](#) parameter is enabled.

See [range sliders](#) for information about range sliders in general.

2.1.15. Learn target range

The learn target range parameter allows you to enable or disable learning for [target range](#).

While active, [target range](#) will be adjusted to accomodate the min and max input loudness. This is useful for quickly setting the target range to match the input loudness. Once the target range is set, you can disable learning to prevent the target range from changing.

2.1.16. Target range presets

Target range presets are provided for convenience as an example set of industry related loudness ranges. The average loudness and limiter peak are provided in the preset names in parenthesis. These values were transcribed from the [RTW](#) delivery standards page.

Currently, the following target range presets are available:

- Standard Reference (≥ -60)
- Spotify Loud (-11, -2)
- Spotify/Tidal/YouTube (-14, -1)
- Deezer (-15, -1)
- Apple (-16, -1)
- AES Streaming (-18, -1)
- EBU R128 Broadcast (-23, -1)
- US TV ATSC A/85 Broadcast (-24, -1)
- Netflix Online Streaming (-27, -1)

2.2. Loudness



The loudness tab contains parameters relating to loudness measurements. You can configure adaptive window behavior here, which can be used to reduce transient artifacts during compression.

2.2.1. Adaptive startup

The adaptive startup parameter enables or disables adaptive startup behavior for loudness measurements. When enabled, the loudness window begins small and grows as the window fills. This can be useful for reducing transient artifacts at the start of playback.

2.2.2. Adaptive edges

The adaptive edges parameter enables or disables adaptive edge detection for loudness measurements. When enabled, loudness values crossing the configured [adaptive threshold](#), or silence, will be detected and the loudness window will be reset. This causes the [adaptive startup](#) behavior to apply to every transition to/from silence. This can be useful for reducing transient artifacts during sudden changes in loudness.

2.2.3. Adaptive type

The adaptive type parameter allows [adaptive startup](#) and [adaptive edges](#) to be configured for Silence or [adaptive threshold](#) modes. Silence mode will only reset the loudness window when the input signal is silent. Adaptive threshold mode will reset the loudness window when the input signal crosses the configured [adaptive threshold](#).

2.2.4. Adaptive threshold

The adaptive threshold parameter allows you to configure the threshold used by [adaptive edges](#) in [adaptive threshold](#) mode. This threshold is specified in the same units as the current [loudness type](#).

2.3. Visualization



The visualization tab contains parameters related to real-time configuration of the meter's visualizations. This section describes these various settings.

2.3.1. Auto range

The auto range parameter enables or disables the visualization's auto range finding capabilities. This feature operates by analyzing the continuous histogram at each frame to determine a reasonable range for that moment in time. This range is then followed and adjusted smoothly over time.

2.3.2. Visual range presets

Visual range presets are provided for convenience as an example set of industry related loudness ranges.

Currently, the following visual range presets are available:

- Auto Range (Global)
- Auto Range (Per Panel)
- Standard Reference (≥ -60)
- Full Range (≥ -70)
- Custom Range ...

2.3.3. Loudness range

The loudness range parameter allows the visualization loudness range to be set manually. In order for this range to be enabled and used, the [visual range presets](#) parameter must be set to "Custom Range"

Note that there are separate loudness ranges for windowed loudness types and peak loudness types.

See [range sliders](#) for information about range sliders in general.

2.3.4. Snapshots

The snapshots feature allows you to take a snapshot of the current histogram. This can be useful for comparing histograms.

Each source/target/output signal has its own snapshot. The snapshots are persisted with plug-in state, so they will be available when you reopen the project.

Snapshots can be operated using the popup menu or via keyboard shortcuts.

The following snapshot parameters are available:

- Save/clear snapshot (saves or clears the current histogram)
 - Source = Cmd + 1
 - Target = Cmd + 2
 - Output = Cmd + 3
- Fill snapshot (fills the area under the snapshot)
 - Source = Cmd + Alt + 1
 - Target = Cmd + Alt + 2
 - Output = Cmd + Alt + 3
- Show/hide snapshot (shows or hides the snapshot in the visualization)
 - Source = Cmd + Shift + 1
 - Target = Cmd + Shift + 2
 - Output = Cmd + Shift + 3

On Windows, use Ctrl instead of Cmd.

2.3.5. Layout options

The options menu allows you to configure the layout of the visualization. The following options are available:

- [layout source mode](#) : Specifies the layout mode for the [source](#) signal.
- [layout target mode](#) : Specifies the layout mode for the [target](#) signal.
- [layout output mode](#) : Specifies the layout mode for the [output](#) signal.
- [raster type](#) : Specifies the type of raster visualization.
- [raster orientation](#) : Specifies the orientation of the raster visualization.
- [show thresholds](#) : Specifies whether or not to show thresholds.
- [show statistics](#) : Specifies whether or not to show loudness statistics.
- [show axis labels](#) : Specifies whether or not to show loudness axis labels.
- [show axis lines](#) : Specifies whether or not to show loudness axis lines.
- [show param context](#) : Specifies whether or not to show parameter context while certain parameters are changing.

Each layout mode has an AUTO option which automatically selects the best layout mode based on the current context.

2.3.6. Layout source mode

The layout source mode parameter allows you to configure the layout of the visualization's source panel.

Currently, the following layout source modes are available:

- None (No source panel is displayed)
- Auto (Automatically selects the best layout mode based on the current context)
- Source only (Draws just the [source](#) signal)
- Source over Target (Draws the [target](#) signal first, then the [source](#) signal on top)
- Source over Output (Draws the [output](#) signal first, then the [source](#) signal on top)

2.3.7. Layout target mode

The layout target mode parameter allows you to configure the layout of the visualization's target panel.

Currently, the following layout target modes are available:

- None (No target panel is displayed)
- Auto (Automatically selects the best layout mode based on the current context)
- Target only (Draws just the [target](#) signal)
- Target over Source (Draws the [source](#) signal first, then the [target](#) signal on top)
- Target over Output (Draws the [output](#) signal first, then the [target](#) signal on top)

2.3.8. Layout output mode

The layout output mode parameter allows you to configure the layout of the visualization's output panel.

Currently, the following layout output modes are available:

- None (No output panel is displayed)
- Auto (Automatically selects the best layout mode based on the current context)
- Output only (Draws just the [output](#) signal)
- Output over Source (Draws the [source](#) signal first, then the [output](#) signal on top)
- Output over Target (Draws the [target](#) signal first, then the [output](#) signal on top)

2.3.9. Delta field type

The delta field type parameter allows you to specify the type of delta field used by the visualization.

The delta field is basically a mapping from each source pixel on the screen to a destination pixel. Pixel shaders are used to iteratively apply this delta field using interpolation and some light dithering effects. This feature is purely for aesthetic purposes and has no effect on the audio.

[Raster type](#) effects are drawn into the delta field on each frame.

2.3.10. Bits per pixel

The bits-per-pixel parameter determines the number of bits per pixel to use when rendering visualizations. The default bpp is the best performing. You can increase bpp to improve visual quality.

2.3.11. Milk Mode

The "Milk mode" parameter enables/disables milk mode. In milk mode, the visualizations will look smoother and behave more like a screensaver at the expense of accuracy. This feature is purely for entertainment purposes.

2.3.12. Bucket size

The bucket size parameter determines the size in pixels of visualization buckets (rectangles).

2.3.13. Histogram hold

The histogram hold parameter enables or disables "hold" mode for the [histogram](#) raster types. While "hold" mode is enabled, the histogram will continuously accumulate measurements indefinitely. This can be used to capture a full duration view of your source audio. This allows you to easily adjust ranges to target to a specific region of the full dynamic range.

The histogram will still continuously accumulate measurements while "hold" mode is disabled, but for each new measurement the oldest measurement in history is replaced. This results in a continuously evolving histogram of duration specified by the [history length](#) parameter.

2.3.14. Delta X/Y/T

The delta X/Y/T parameters are provided to the visualization [delta field](#) in order to manipulate the delta field in real-time. The exact behavior of each parameter depends on the active [delta field type](#).

2.3.15. Delta field

The delta field parameter allows you to enable or disable the visualization delta field.

The delta field is basically a mapping from each source pixel on the screen to a destination pixel. Pixel shaders are used to iteratively apply this delta field using interpolation and some light dithering effects. This feature is purely for aesthetic purposes and has no effect on the audio.

[Raster type](#) effects are drawn into the delta field on each frame.

2.3.16. Shader params

The shader parameters control various aspects of visualization rendering. The following options are available:

- Shader param 1: Delta field fade rate. Lower values leave longer trails.
- Shader param 2: Curve fill transparency. Lower values make the curve more transparent, leaving only the edge(s) visible.
- Shader param 3: Curve edge thickness. Lower values make the edge thinner.

2.3.17. Show thresholds

The show thresholds parameter allows you to enable or disable threshold drawing in the visualization.

If this option is disabled, thresholds will still be drawn while changing the associated parameters.

Thresholds are defined by the [target range](#) parameter.

2.3.18. Panel params

The panel parameters control various aspects of panel rendering. The following options are available:

- Panel param 1: Panel alpha (transparency), 0.0 to remove panel completely
- Panel param 2: Panel hue (rotates through normal, source, target, output).
- Panel param 3: Panel hue intensity

2.3.19. History length

The history length parameter allows you to change the duration of visualization history. This history is a rolling-window where each new loudness sample pushes out the oldest sample, maintaining a continuous history length with the duration you've configured here. Note that this setting applies both to [history](#) and [histogram](#) raster types.

During [histogram hold](#) the histogram has an effectively infinite history length.

2.3.20. Show statistics

The "Show statistics" option allows you to show or hide the loudness statistics text overlay.

2.3.21. Show axis labels

The show axis labels parameter allows you to enable or disable axis drawing in the visualization.

The axis is scaled relative to the [loudness range](#), which can be manual or [auto range](#).

2.3.22. Show axis lines

The show axis lines parameter allows you to enable or disable axis line drawing in the visualization.

axis lines are drawn at each [Show axis labels](#).

2.3.23. Show param context

The show param context parameter allows you to enable or disable param context text bubbles during parameter changes.

2.4. Theme



The theme tab contains parameters related to color themes. Here you can select between the bank of color theme presets, or configure the individual colors yourself.

2.4.1. Theme presets

The theme presets combo-box allows you to switch between a variety of theme presets. Each theme has a light and dark variation. Switching between theme presets will load values into [source color](#), [normal color](#), [target color](#) and [output color](#).

Currently, the following themes are available:

- APU Default
- APU Red
- APU Vermilion
- APU Orange
- APU Amber
- APU Yellow
- APU Lime
- APU Chartreuse
- APU Harlequin
- APU Green
- APU Erin
- APU Spring
- APU Aquamarine
- APU Cyan
- APU Turquoise
- APU Azure
- APU Cerulean
- APU Blue
- APU Indigo
- APU Violet
- APU Purple
- APU Magenta
- APU Raspberry
- APU Rose
- APU Crimson

2.4.2. Source color

The source color parameters control the red, green, and blue components of the [source](#) color.

The source color is used in a variety of contexts, from interactive widgets to visualization elements. This color signifies that an element relates to the [source](#) signal in some way. This color is expected to contrast against the [normal color](#) to some extent.

2.4.3. Normal color

The normal color parameters control the red, green, and blue components of the “normal” color.

The normal color is used in a variety of contexts, from interactive widgets to visualization elements. This color signifies that an element is essentially neutral, not related to [source](#), [target](#) or [output](#) signal. This color is expected to contrast against the [source color](#), [target color](#), and [output color](#) to some degree.

2.4.4. Target color

The target color parameters control the red, green, and blue components of the [target](#) color.

The target color is used in a variety of contexts, from interactive widgets to visualization elements. This color signifies that an element relates to the [target](#) signal in some way. This color is expected to contrast against the [normal color](#) to some extent.

2.4.5. Output color

The output color parameters control the red, green, and blue components of the [output](#) color.

The output color is used in a variety of contexts, from interactive widgets to visualization elements. This color signifies that an element relates to the [output](#) signal in some way. This color is expected to contrast against the [normal color](#) to some extent.

2.4.6. Textures

The textures configuration allows you to change the user interface textures.

The panel texture is used for the background of the user interface and has the [shader params](#) applied. The meter texture is used to fill the visualization effects. The background texture is used throughout the plug-in for shading.

These settings are stored with user scope, so you don't need to change them with every instance. Closing a texture will revert to the default internal texture.

Typically, the panel texture should be very dark and the meter texture should be very light.

2.5. Settings



The settings tab contains various additional parameters. These parameters are broken down between General and Latency parameters. Since Latency parameters impact [delay compensation](#), changes to these parameters are deferred until you click the Apply button. It is generally not advisable to automate the parameters in the Latency section.

2.5.1. BPM

The bpm option allows you to set the BPM used by tempo-relative parameters.

2.5.2. Host BPM

The host bpm option enables usage of the host's BPM for tempo-relative parameters. When disabled, the [bpm](#) parameter is used instead.

This parameter is not available (nor applicable) to the standalone application.

2.5.3. Velocity sensitive knobs

If enabled, this will turn on velocity-sensitive dragging, so that the faster the mouse moves, the bigger the movement to the knobs. This helps when making accurate small-scale adjustments.

This parameter is saved at user scope, so it will be remembered between sessions.

2.5.4. Load preset visuals

The load preset visuals option allows you to enable/disable the loading of visualization and [theme](#) settings when loading [presets](#). All other settings will still be loaded; this setting only has an impact on the visual appearance of the plug-in and does not impact the audio.

This parameter is saved at user scope, so it will be remembered between sessions.

2.5.5. Load preset ranges

The load preset ranges option allows you to enable/disable the loading of [target range](#) when loading [presets](#). All other settings will still be loaded.

This parameter is saved at user scope, so it will be remembered between sessions.

2.5.6. UI Scaling

The UI scaling option allows you to set the scaling of the user interface. This is useful for high-DPI displays, where the default scaling may be too small to read comfortably.

This parameter is saved at user scope, so it will be remembered between sessions.

2.5.7. Dark mode

The dark mode toggle enables/disables dark mode. When enabled, theme colors have their brightness inverted.

2.5.8. Blocksize

The block size parameter determines the time resolution of the meter's loudness measurements. Generally speaking, lower block sizes will give more accurate results. However, lower block sizes also require more CPU resources, so it is necessary to find a balance. You can squeeze improved quality and/or performance out of the meter by tuning this setting based on your available CPU resources.

BPM units for block size are evaluated once at the time you press Apply.

2.5.9. Delay compensation

The delay compensation parameter determines whether or not the plug-in will report latency to the host. Delay compensation is used by hosts to keep audio synchronized across channels.

The delay compensation option is not available (nor applicable) to the standalone application.

2.6. Update

The update tab allows you to check for the latest product versions. Just click “Check for updates” to see the latest version numbers. If you’re not running the latest version, you can click “Download” to open the download page in your default browser.

2.7. About

The about tab contains basic information about the plug-in.

3. Glossary

This section defines some of the concepts used within the software.

3.1. Range sliders

Range sliders are used throughout the plug-in in order to specify the upper and lower boundaries of a range. These ranges can be controlled via mouse in various ways.

- Click and drag the lower thumb to adjust the minimum value.
- Click and drag the upper thumb to adjust the maximum value.
- Click and drag the region between slider thumbs to move both values. This allows you to adjust the average loudness without expanding/contracting the dynamic range.
- Ctrl + click and drag the region between slider thumbs to expand/contract range without changing the average (center) value. Drag the mouse up and down, left and right are ignored.
- Shift + click and drag the region between slider thumbs to combine both. Drag the mouse up and down to expand/contract range. Drag the mouse left and right to move both values.

3.2. History

One of the primary views into your audio that this software provides is real-time history. The history view maintains a recent history of loudness measurements, continuously displaying them in [FIFO](#) order. This view helps you understand how the signal is changing over time, in real-time. [History length](#) and [bucket size](#) can be configured dynamically without forcing the history to reset.

3.3. Histogram

One of the primary views into your audio that this software provides is a real-time histogram. Histograms in general provide a quick and intuitive way to understand the relative frequency of different measurements. This is very useful when judging the overall dynamic range of the audio. The histogram provided by this software is capable of changing [history length](#), [bucket size](#) and size continuously.

3.4. Source

The term “source” is used throughout the plug-in to identify the plug-in’s input source signal. This signal is represented in the user interface by the current theme’s [source color](#).

3.5. Target

The term “target” is used throughout the plug-in to identify the configured target range loudness. This signal is represented in the user interface by the current theme’s [target color](#).

3.6. Output

The term “output” is used throughout the plug-in to identify the [output type](#) signal. This signal is represented in the user interface by the current theme’s [output color](#).

4. Credits

This software was developed by [APU Software, LLC](#) and is available as VST (windows x64/x86, macOS universal), Audio Unit (macOS universal), Pro Tools AAX (windows x64, macOS universal), or Standalone Application (windows x64/x86, macOS universal). The software libraries below are utilized for portions of the software:

- [JUCE](#) (cross-platform audio and user interface framework)
- [Boost](#) (header-only algorithms)
- [libebur128](#) (loudness measurements)
- [melatonin_blur](#) (blur effects)

Demo video song credits:

- Annasara - A Lifetime Rolls By, licensed via [Audiio](#)



4.1. MIT License ([libebur128](#))

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4.2. MIT License ([melatonin_blur](#))

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