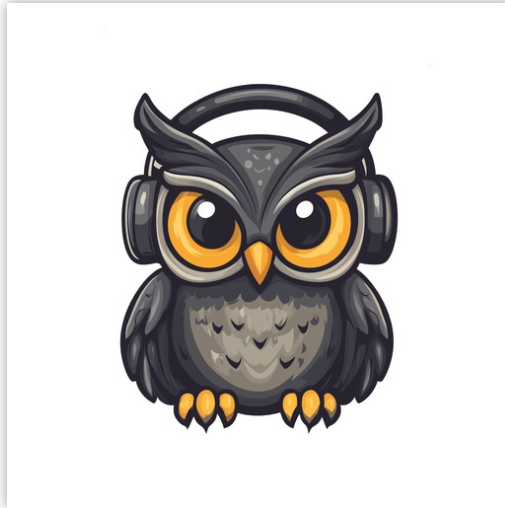


# APU Dynamics Optimizer



User Manual  
v4.4.7

# Table of Contents

Table of Contents	2
1. Introduction	4
2. Parameters	4
2.1. Optimization	4
2.1.1. Presets	6
2.1.2. Loudness type	6
2.1.3. RMS window	6
2.1.4. Momentary window	6
2.1.5. Short-term window	7
2.1.6. Output type	7
2.1.7. Visualization	7
2.1.8. Raster type	7
2.1.9. Source range	7
2.1.10. Source range presets	8
2.1.11. Target range	8
2.1.12. Target range presets	8
2.1.13. Analyze all	8
2.1.14. Playback controls	8
2.1.15. Distribution range type	8
2.1.16. Distribution skew	8
2.1.17. Distribution type	9
2.1.18. Ballistics type	9
2.1.19. IIR contour type	9
2.1.20. Low-Level type	9
2.1.21. Gate mode	9
2.1.22. Attack/Release	10
2.1.23. Attack/Release hold	10
2.1.24. Gate attack/release	10
2.1.25. Gate attack/release hold	10
2.1.26. Linear Attack/Release	10
2.1.27. Look-ahead	11
2.1.28. Look-ahead mode	11
2.1.29. Dry/Wet	11
2.1.30. Output gain	11
2.2. Loudness	12
2.2.1. Adaptive startup	12
2.2.2. Adaptive edges	12
2.2.3. Adaptive type	12
2.2.4. Adaptive threshold	12
2.3. Limiter	13
2.3.1. Limiter mode	13
2.3.2. Limiter threshold	13
2.3.3. Limiter ceiling	13
2.3.4. Limiter threshold link	13
2.3.5. Limiter lookahead	13
2.4. Visualization	14
2.4.1. Auto range	14
2.4.2. Visual range presets	14
2.4.3. Loudness range	14
2.4.4. Snapshots	15
2.4.5. Layout options	15
2.4.6. Layout source mode	15
2.4.7. Layout target mode	16
2.4.8. Layout output mode	16
2.4.9. Delta field type	16
2.4.10. Bits per pixel	16
2.4.11. Breath residual	16
2.4.12. Bucket size	16
2.4.13. Histogram hold	17
2.4.14. Delta X/Y/T	17
2.4.15. Delta field	17
2.4.16. Shader params	17
2.4.17. Show thresholds	17
2.4.18. Panel params	17
2.4.19. History length	17
2.4.20. Show peak meter	18
2.4.21. Show axis labels	18
2.4.22. Show axis lines	18
2.4.23. Show param context	18
2.5. Theme	18
2.5.1. Theme presets	19
2.5.2. Source color	19

2.5.3. Normal color	19
2.5.4. Target color	19
2.5.5. Output color	20
2.5.6. Textures	20
2.6. Settings	20
2.6.1. BPM	20
2.6.2. Dither	20
2.6.3. Look-ahead budget	21
2.6.4. Velocity sensitive knobs	21
2.6.5. Load preset visuals	21
2.6.6. Load preset ranges	21
2.6.7. UI Scaling	21
2.6.8. Dark mode	21
2.6.9. Blocksize	21
2.7. Update	21
2.8. About	22
3. Glossary	22
3.1. Range sliders	22
3.2. History	22
3.3. Histogram	22
3.4. Source	22
3.5. Target	22
3.6. Output	22
4. Credits	23
4.1. MIT License (libebur128)	23
4.2. MIT License (melatonin_blur)	23
4.3. MIT License (r8brain)	24

# 1. Introduction

[APU Dynamics Optimizer](#) is a loudness optimization tool released by [APU Software, LLC](#). You can read about the different features and parameters in this documentation.

## 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.

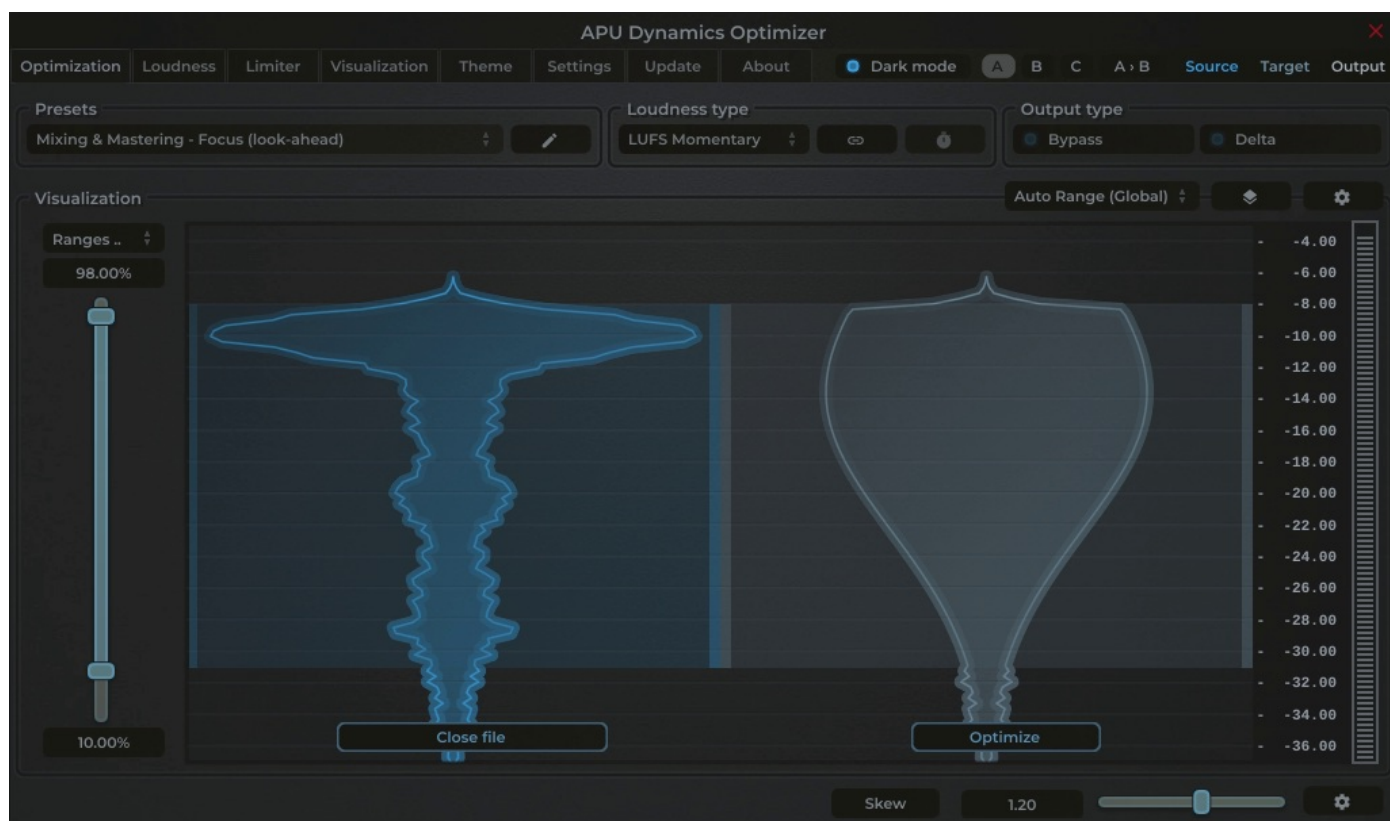
### 2.1. Optimization



The optimization tab leads you through the optimization process. First, you can open an audio file for analysis. You can either use the file open button to browse for a file, or you can drag and drop a file onto the window. From that point, you'll be able to select a range of the audio to optimize.

The default range is set to match the percentiles used by the LRA ("loudness range") algorithm. This is generally a good starting point for most audio. However, you can adjust the range to suit your needs. Loudness outside of this range will have make-up gain applied automatically, and you can adjust that behavior further using the [low-level type](#) parameter.

You can also simply select the entire range (100%, 100%) and then adjust the [distribution skew](#) parameter to roughly match the shapes. This gives you a good starting point for adjusting the overall loudness and dynamic range after optimization.



Once you have selected a range, you can press the right arrow button to perform the optimization. After optimization is complete, you can use the playback controls to listen to the results. From here you can make adjustments to [attack/release](#) and other parameters. Once you are happy with the results, press the downward arrow button to render to 32-bit float wav file.

All processing done by this optimizer is done in the same sample rate as the input file, using 32-bit float samples. This is done to maximize the quality of the output file and to avoid any clipping.



### 2.1.1. Presets

Dynamics Optimizer's presets combo-box contains a collection of basic presets, one for each combination of [loudness type](#) and latency configuration. The low-latency presets introduce minimal delay, while the look-ahead presets introduce more delay in exchange for the ability to preemptively respond to the source signal.

See [look-ahead](#) for an understanding of how delay compensation works in the plug-in.

When switching between presets, your [source range](#) and [target range](#) won't be modified when [load preset ranges](#) is disabled. This is done to make it easier to flip through different optimizer presets after you've configured the range settings. Note that peak modes have their own units scale and as a result they use a separate source and target range; the sliders for these settings are swapped into view automatically when switching between loudness modes.

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. These settings are visual only, they don't have any impact on the audio behavior of the optimizer.

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

- Full Reset
- Mixing & Mastering - Focus (look-ahead)
- Mixing & Mastering - Present (look-ahead)
- Mixing & Mastering - Deep (look-ahead)
- Mixing & Mastering - Traditional (look-ahead)
- Mixing & Mastering - Maximizer TP (look-ahead)
- Mixing & Mastering - Maximizer PK (look-ahead)
- Mixing & Mastering - Focus (low-latency)
- Mixing & Mastering - Present (low-latency)
- Mixing & Mastering - Deep (low-latency)
- Mixing & Mastering - Traditional (low-latency)
- Mixing & Mastering - Maximizer TP (low-latency)
- Mixing & Mastering - Maximizer PK (low-latency)

### 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 options allows you to configure which type of samples to output.

- Default output type corresponds to Dynamics Optimizer's output
- Bypass output type corresponds to Dynamics Optimizer's source
- Delta output type corresponds to Dynamics Optimizer's output minus source

Output gain and dry/wet are bypassed for Delta output type

### 2.1.7. Visualization

---

The visualization component displays a continuously evolving real-time view of your [source](#), [target](#), 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 [source range](#) and [target range](#), allowing you to precisely target these ranges 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 resize 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 [source](#) and [target](#) or [output](#) loudness.

Delta view is useful for determining how much loudness is being changed, and how much residual there is between [target](#) and [output](#) loudness.

You can also visualize [target](#) vs [output](#) residual via [breath residual](#) option.

### 2.1.9. Source range

---

The source range parameter allows you to specify a min and max loudness value for the [source](#) signal. Loudness values within the source range are mapped onto the [target range](#) to determine the amount of gain reduction or amplification. The resulting target is then followed by the optimizer using the configured [attack/release](#) and/or [linear attack/release](#) parameter settings.

The source range is adjusted using percentile + offset parameters. This allows you to set the source range to span a particular percentile of the input loudness distribution. The offset parameter allows you to adjust the source range up or down in loudness. Both of these parameters are controlled in units of percentiles.

The LRA preset can be used to match the range used by the [LRA](#) algorithm.

---

### 2.1.10. Source range presets

Source range presets are provided for convenience to quickly set the source range to span a particular percentile of the input loudness distribution.

Currently, the following source range presets are available:

- Full
- LRA

---

### 2.1.11. Target range

The target range parameter allows you to specify a range for the [target](#) signal. See [distribution range type](#) for more details.

---

### 2.1.12. 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:

- 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)

---

### 2.1.13. 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. Playback controls

The playback controls allow you to hear the optimizer's output prior to exporting. You can play, pause, stop, and seek the audio while listening to the results in real-time. The seek bar may be used to set the current playback position. Using these controls, you can quickly audition the optimizer's output and make any necessary adjustments before exporting.

Press the 'Export file(s) ...' button to save the optimizer's output to a file. The result will be saved in 32-bit float wave format, which is the same format used internally by the optimizer.

If you have multiple files loaded, the optimizer will export all files with the same settings.

---

### 2.1.15. Distribution range type

The distribution range type parameter allows you to change how you configure the target distribution range.

- Min/Max allows you to specify the range as min/max values
- Loudness/Range allows you to specify the range as loudness/range values

---

### 2.1.16. Distribution skew

The distribution skew parameter allows you to adjust the shape of the target distribution. This parameter applies only to normal distribution type, and is implemented using standard skewed normal distribution formula. The skew parameter is a floating point value that can be positive or negative.



### 2.1.17. Distribution type

---

The distribution type combo-box allows you to change the distribution algorithm type.

- Uniform distribution is a flat distribution.
- Normal distribution is a bell curve distribution.

Normal distribution can be skewed using the [distribution skew](#) parameter.

### 2.1.18. Ballistics type

---

The ballistics type combo-box allows you to change Dynamics Optimizer's ballistics behavior.

- Natural (dithered) applies light dithering to natural ballistics deltas.
- Natural (direct) applies normal smooth attack and release ballistics.
- Inertial (dithered) applies light dithering to inertial ballistics deltas.
- Inertial (direct) applies attack and release ballistics with inertia.

Inertial ballistics are more responsive to sudden changes in loudness, but may sound less natural.

Dithering can help reduce quantization noise, but may be less accurate

### 2.1.19. IIR contour type

---

The IIR contour type combo-box allows you to change the LUFS [loudness type](#)'s IIR filter contour. The following contours are supported:

- K-weighting
- ECMA-418
- ITU-R 468
- A-weighting
- C-weighting

Contours other than K-weighting no longer conform to the LUFS standard, but are provided for flavor and perceptual precision.

### 2.1.20. Low-Level type

---

The low-level type combo-box allows you to change Dynamics Optimizer's behavior for loudness levels below the [source range](#).

- Makeup applies the difference between [target](#) min and [source](#) min to all loudness levels.
- Bypass maintains current gain when loudness levels are below [source](#) min.
- Gate applies silence to loudness levels below [source](#) min.

The [attack/release](#) and [linear attack/release](#) ballistics apply to all low-level types

### 2.1.21. Gate mode

---

The gate mode setting allows you to choose between different gate behaviors separately for attack and release.

- sync always applies the normal [attack/release](#) ballistics
- ms applies a custom attack/release time in milliseconds while the gate is closed
- ms-soft transitions between sync and ms modes during hold time

The gate is only active when the [low-level type](#) is set to gate.

### 2.1.22. Attack/Release

---

The attack and release parameters allow you to specify the amount of time it takes for a given amount of gain reduction to be applied to the [source](#) signal. Attack refers to the “attack” of applying gain reduction, while release refers to the “release” of this gain reduction. More generally, release refers to gain amplification since it isn’t always necessary for the optimizer to “attack” prior to “release” and the two are not always correlated.

Attack and release are traditional ballistic parameters, similar to what you will find on most compressors. See the [Linear attack/release](#) parameters for more direct attack/release behavior. In addition to specifying the attack and release in milliseconds, you can specify them in sample, BPM-relative units, or ratio of [look-ahead](#) duration.

### 2.1.23. Attack/Release hold

---

The attack and release hold parameters allow you to specify the amount of delay before [attack/release](#) phase begins.

Release hold maintains gain reduction (“attack”) for the specified release hold time. Attack hold maintains gain amplification (“release”) for the specified attack hold time.

### 2.1.24. Gate attack/release

---

The gate attack and release parameters allow you to specify the time it takes for the gate to open or close. The gate is closed when the source signal is below the [source range](#) min.

Note that gate attack is the time it takes for the gate to open, while gate release is the time it takes for the gate to close.

The gate is only active when the [low-level type](#) is set to gate.

### 2.1.25. Gate attack/release hold

---

The gate attack and release hold parameters determine the transition time between gate attack/release and normal attack/release.

Note that gate attack is the time it takes for the gate to open, while gate release is the time it takes for the gate to close.

The gate is only active when the [low-level type](#) is set to gate.

### 2.1.26. Linear Attack/Release

---

The linear attack and release parameters allow you to directly specify the rate of change in gain reduction applied to the [source](#) signal. Attack refers to the “attack” of applying gain reduction, while release refers to the “release” of this gain reduction. More generally, release refers to gain amplification since it isn’t always necessary for the optimizer to “attack” prior to “release” and the two are not always correlated.

Linear attack and release parameters are different from traditional ballistic parameters. The actual rate of change in gain reduction with the traditional controls is dependent on both the attack or release time and the residual between target gain reduction and current gain reduction. This means the alterations made to the source signal are a complicated combination of the audio’s dynamics. For linear attack and release, the actual rate of change is constant.

This setting can be configured to apply directly, completely overriding the [attack/release](#) ballistics, or as a limit to their rate. The former can be a way to get extremely fast response, while the latter can serve as a barrier to prevent the optimizer from attacking or releasing too rapidly during extreme fluctuations in [source](#) loudness.

### 2.1.27. Look-ahead

---

The look-ahead parameter allows you to configure how far in advance the loudness measurement looks for the [source](#) signal. This can be used to align Dynamics Optimizer's response to account for the loudness window time and/or attack/release times, or simply as a creative effect.

Look-ahead requires that the [look-ahead budget](#) parameter is configured via the [settings](#) tab. This method of look-ahead configuration is used to support real-time adjustments of look-ahead without causing stuttering which would otherwise interfere with A/B testing.

Note that [look-ahead budget](#) adds latency to the optimizer in order to function.

### 2.1.28. Look-ahead mode

---

The look-ahead mode parameter allows you to specify the look-ahead algorithm.

- OFF completely disables look-ahead
- Offset reacts to the newest sample in the look-ahead window
- Average reacts to the average of the entire look-ahead window
- Peak reacts to the newest sample in the look-ahead window (attack only)
- Floor reacts to the newest sample in the look-ahead window (release only)

The look-ahead window duration can be configured using the [look-ahead](#) parameter.

### 2.1.29. Dry/Wet

---

The dry/wet parameter allows you to configure the percentage of compression to mix into the dry signal.

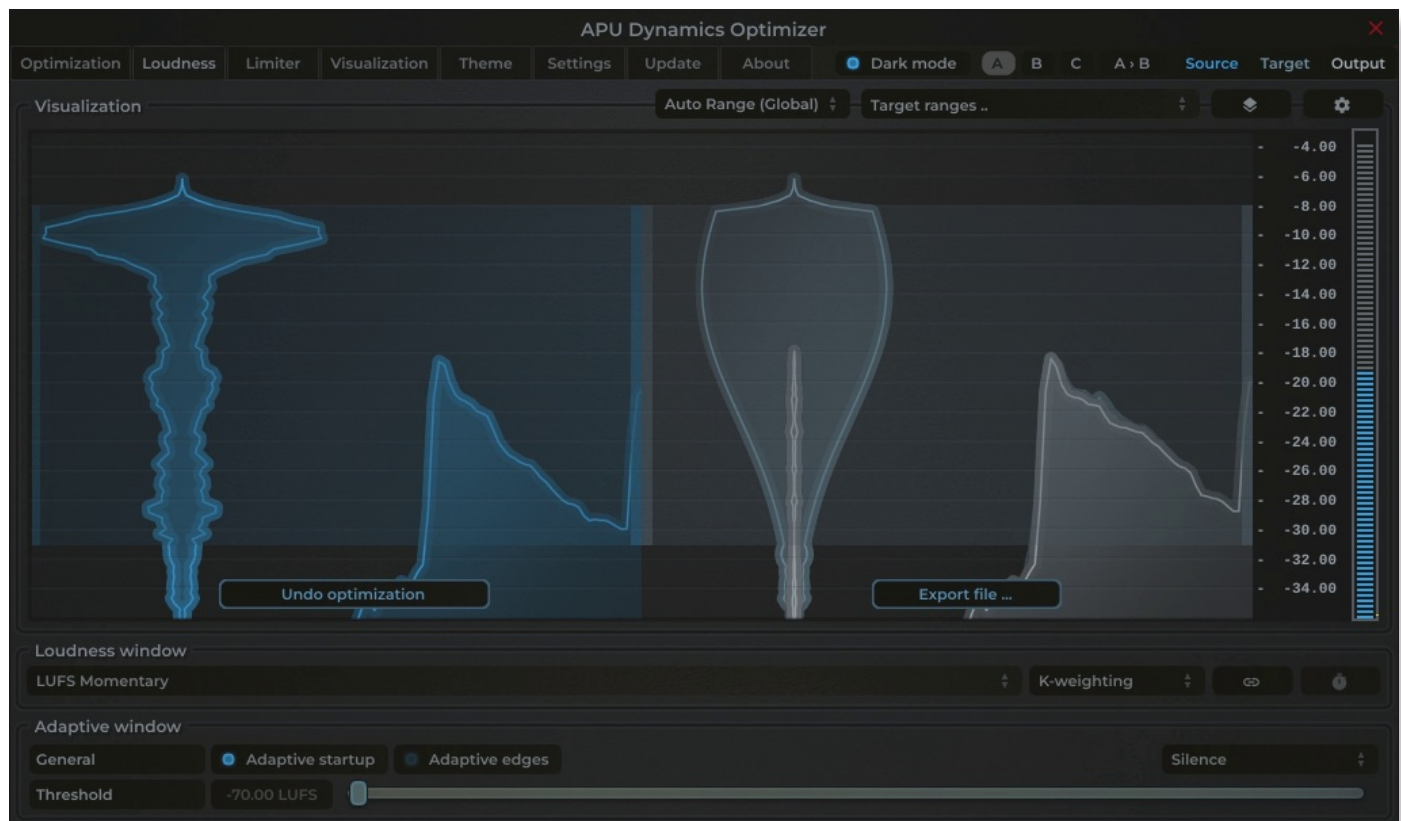
This feature can be used to apply [parallel compression](#).

### 2.1.30. Output gain

---

The output gain parameter allows you to apply additional gain to the output of the optimizer.

## 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.

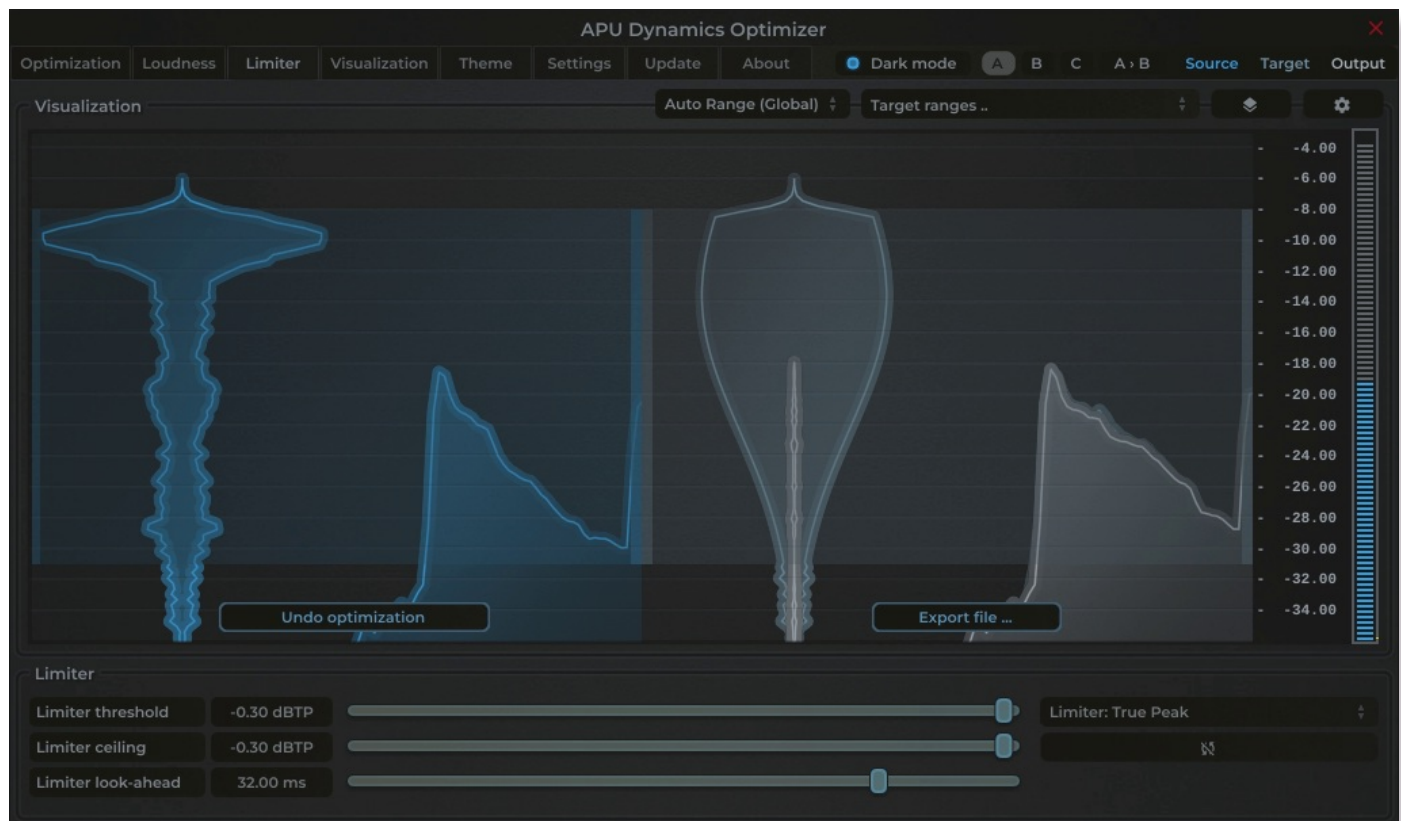
### 2.2.3. Adaptive type

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. Limiter



The limiter tab contains parameters relating to the built-in limiter. The limiter scans the [limiter lookahead](#) region of blocks for peak or true peak loudness values over the [limiter ceiling](#). When these peaks are encountered, the current gain reduction trajectory is adjusted to accommodate the peak.

### 2.3.1. Limiter mode

The limiter mode parameter lets you decide which peaks, if any, will be used for detection. The following options are available:

- None: No limiting
- Peak: Digital peaks are detected
- True Peak: Intra-sample peaks are detected according to the LUFS True Peak specification.

### 2.3.2. Limiter threshold

The limiter threshold parameter determines the loudness at which the limiter starts to apply gain reduction. Loudness values above threshold are raised to the [limiter ceiling](#).

### 2.3.3. Limiter ceiling

The limiter ceiling parameter determines the maximum peak loudness value that the limiter will allow. When the limiter detects a peak above this value, it will pre-emptively begin to apply gain reduction. Note that make-up gain is not automatically applied.

### 2.3.4. Limiter threshold link

The limiter threshold link parameter allows you to link the [limiter threshold](#) and [limiter ceiling](#) parameters. When linked, the ceiling will automatically adjust to match the threshold.

### 2.3.5. Limiter lookahead

The limiter look-ahead parameter determines the amount of time to look into the future when detecting peaks. Shorter lookahead times will result in more aggressive gain reduction, with the results becoming more gritty and distorted. Longer lookahead times will result in more transparent gain reduction, but will push the average level of the audio further down.

## 2.4. Visualization



The visualization tab contains parameters related to real-time configuration of Dynamics Optimizer’s visualizations. This section describes these various settings.

### 2.4.1. 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.

### 2.4.2. 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 ( $\geq -60$ )
- Full Range ( $\geq -70$ )
- Custom Range ...

### 2.4.3. 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.



#### 2.4.4. 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.

#### 2.4.5. 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.
- [show thresholds](#) : Specifies whether or not to show thresholds.
- [show peak meter](#) : Specifies whether or not to show peak meter.
- [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.

#### 2.4.6. 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)



#### 2.4.7. 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)

#### 2.4.8. 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)

#### 2.4.9. 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.

#### 2.4.10. 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.

#### 2.4.11. Breath residual

---

The breath residual parameter can be used to help visualize optimizer behavior. For each frame of the visualization, the current residual between [target](#) and [output](#) loudness is calculated and used to multiply the magnitude of the visualization delta field.

This feature helps you find sections of audio where the optimizer is having a difficult time keeping up with the amount of [target](#) gain. This can help guide the configuration of the [attack/release](#) and [linear attack/release](#) parameters. The direction of the multiplication factor is also set to reflect whether the residual occurred in the attack or release direction, so it's possible to get a sense of the overall balance between these residuals.

#### 2.4.12. Bucket size

---

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

### 2.4.13. 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.

### 2.4.14. 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](#).

### 2.4.15. 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.

### 2.4.16. 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.

### 2.4.17. 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 include [source range](#) and [target range](#).

### 2.4.18. 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

### 2.4.19. 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.

### 2.4.20. Show peak meter

The show peak meter parameter allows you to enable or disable peak meter and gain reduction drawing next to the visualizer.

Positive gain reduction is drawn from bottom-up, negative gain reduction is drawn from top-down.

### 2.4.21. 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](#).

### 2.4.22. 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](#).

### 2.4.23. Show param context

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

## 2.5. 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.

### 2.5.1. 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

### 2.5.2. 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.

### 2.5.3. 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.

### 2.5.4. 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.

### 2.5.5. 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.

### 2.5.6. 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.

## 2.6. Settings



The settings tab contains various additional parameters. These parameters are broken down between General and Latency parameters. Since Latency parameters impact analysis, changes to these parameters are deferred until you click the Apply button, and will require the current file to be closed.

### 2.6.1. BPM

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

### 2.6.2. Dither

The dither parameter determines the strength of ballistics dithering. This parameter applies only to dithering [ballistics type](#) modes.

### 2.6.3. Look-ahead budget

---

The look-ahead budget parameter determines the latency budget which is available for the [look-ahead](#) parameter. Once you have configured a look-ahead budget, you can adjust the [look-ahead](#) parameter in real-time within this range without introducing artifacts.

### 2.6.4. 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.

### 2.6.5. 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.

### 2.6.6. Load preset ranges

---

The load preset ranges option allows you to enable/disable the loading of [source range](#) and/or [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.

### 2.6.7. 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.

### 2.6.8. Dark mode

---

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

### 2.6.9. Blocksize

---

The block size parameter determines the time resolution of Dynamics Optimizer's [source](#) 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 optimizer by tuning this setting based on your available CPU resources.

Fast attack and/or release times may benefit from similarly low block size.

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

## 2.7. 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.

---

## 2.8. About

The about tab contains basic information about the plug-in. This is also where you can activate or deactivate your product keys and check license status.

---

# 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 “ideal” target output loudness. The actual loudness achieved depends on [attack/release](#) and [linear attack/release](#) parameter settings.

---

## 3.6. Output

The term “output” is used throughout the plug-in to identify the actual output loudness. This can differ from [target](#) loudness due to non-instantaneous [attack/release](#) and/or [linear attack/release](#) parameter settings.



## 4. Credits

---

This software was developed by [APU Software, LLC](#) and is available as 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)
- [r8brain](#) (Sample rate converter designed by Aleksey Vaneev of Voxengo)

Demo video song credits:

- Dan Phillipson - Feel The Drama, licensed via [PremiumBeat](#)



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

---

Copyright (c) 2011 Jan Kokemüller

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### 4.2. MIT License ([melatonin\\_blur](#))

---

Copyright (c) 2023 Sudara Williams

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

### 4.3. MIT License (r8brain)

---

Copyright (c) 2013-2023 Aleksey Vaneev

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.