

L3-16 Multimaximizer™

User Manual



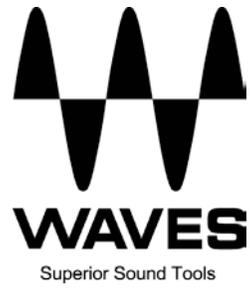


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Chapter 1 – Introduction

1.1 Welcome

Thank you for choosing Waves! In order to get the most out of your new Waves plugin, please take a moment to read this user guide.

To install software and manage your licenses, you need to have a free Waves account. Sign up at www.waves.com. With a Waves account you can keep track of your products, renew your Waves Update Plan, participate in bonus programs, and keep up to date with important information.

We suggest that you become familiar with the Waves Support pages: www.waves.com/support. There are technical articles about installation, troubleshooting, specifications, and more. Plus, you'll find company contact information and Waves Support news.

1.2 Product Overview



The Waves L3-16 Multimaximizer is a 16-band auto-summing peak limiter, the fourth processor in Waves' acclaimed L-Series of Ultramaximizers and Multimaximizers.

Powered by an advanced version of the Waves PLMixer™ Peak Limiting Mixer engine, the L3-16 offers Gain and Priority controls arranged in a 6 band EQ-style interface with familiar parameters like frequency, Q, and filter-type. The L3-16 features a linear phase crossover network to deliver results that are free of phase distortion.

Similar to the Profiles used by its predecessor the L3, the L3-16 offers a wide variety of sonic flavors known as Release Characters, ranging from analog warm to digital cool. Release Characters affect the behavior of the L3-16's ARC™ Automatic Release Control across the split-band spectrum.

Finally, the L3-16 features Waves IDR™ Increased Digital Resolution double precision bit re-quantization and 9th-order noise shaping system, for enhanced audio resolution at any setting.

1.3 Concepts and Terminology

The Peak Limiting Mixer™

A traditional multiband limiter consists of a given number of limiters operating independently of each other, each set to a particular frequency range. The key to the L3-16's power is its patent-pending Peak Limiting Mixer™ (PLMixer™) engine, which uses a single peak limiter to control all of its bands.

Dividing the audio spectrum into 16 bands using linear phase crossover filters, the PLMixer™ uses psychoacoustic criteria to intelligently decide how much attenuation to apply to each band, using all available headroom. The PLMixer™ incorporates superimposed Gain and Priority curves that allow the user to set gain (which functions exactly like placing a linear phase EQ before the L3-16's limiting section) and priority (relative limiting) across the audio spectrum. The result is that inter-modulation distortion is minimized and overall loudness is maximized, while retaining the simplicity of a single master threshold control.

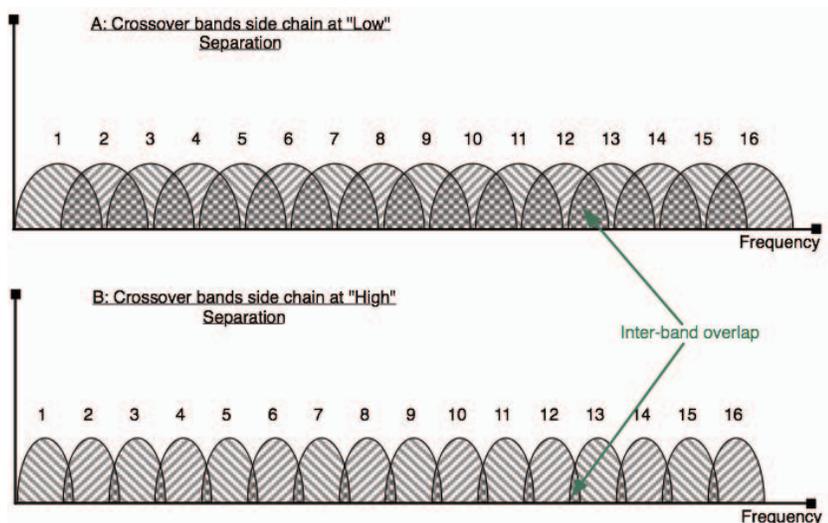
Unlike traditional multiband limiters, the PLMixer™ does not require a wide band peak limiter to catch overshoots generated by individual band adjustments; it automatically controls the gain relationship between bands while maintaining brickwall limiting.

Limiter bands vs. Paragrophic-EQ bands

The L3-16's Gain/EQ and Priority curves make for a very powerful mastering tool, enabling both paragrophic equalization and multiband limiting. Controlled by a 6-band Paragrophic EQ-style interface, these curves are implemented by a 16-band linear phase crossover engine. The Equalization (Gain) and Priority curves are essentially overlaid on top of the 16 bands, in the way you would overlay a frequency-response curve on a graphic EQ's sliders.

Separation

The L3-16 linear phase crossover allows control over the amount of Separation between its 16 bands. Separation is basically the cutoff slope (or Q) between the bands. At low Separation settings, crossover slopes between bands are moderate, creating more overlap between the bands. At higher Separation settings, the crossover slopes are steeper, resulting in less overlap between the bands.



The L3-16 Release Character System

The L3-16 offers a wide range of sound qualities which are controlled using the release settings across its 16 bands.

Like its predecessor the L3, the L3-16's band release times are determined by Waves ARC™ Auto Release Control, which dynamically chooses the optimal release value for a wide range of inputs. The ARC system, like the human ear, analyzes and reacts to RMS and peak transients differently, resulting in increased RMS level with greater clarity.

Since ARC™ allows independent release values for each band, a wide range of sound colors are possible. We consolidated these settings into Release Character presets, since the control of so many parameters is a potentially cumbersome task.

For example, a Release Character could consist of relatively fast release values for the low frequency bands, with gradually slower release values for the higher frequencies. Accordingly, this character would apply more attenuation to the higher frequency range.

The L3-16's Release Character system is further controlled by the Release fader, which proportionately shortens or lengthens each band's release values.

The L3-16 offers a wide range of preset Release Characters, and we highly suggest that you experiment with its various parameters in order to discover the wide range of sonic flavors the L3-16 can achieve.

1.4 Components

WaveShell technology enables us to split Waves processors into smaller plug-ins, which we call **components**. Having a choice of components for a particular processor gives you the flexibility to choose a configuration suitable for your material.

The L3-16 has two component processors:

Stereo - A stereo channel processor.

Mono – A mono channel processor.

Chapter 2 – Quickstart Guide



We recommend reading this manual to get the most out of the L3-16. However, for a quick start to setting up the L3-16 on your audio, follow these steps:

1. Insert the L3-16 Multimaximizer into your project, preferably as the last processor on the master buss with no subsequent gain adjustment.
2. Play your audio, selecting a section with a high RMS level.
3. Experiment with various presets from the “Load” pull-down menu.
4. Select the Threshold/Out Ceiling Link control, located between the Input and Output meters, and drag downward while watching the Attenuation meter.
5. Once the Attenuation meter registers gain reduction, listen carefully and continue to drag downward until you hear degradation, distortion, or a reduction in level.
6. At this point, stop, and drag upward until the output sound is free of such degradations.
7. Set the Out Ceiling control to -0.2dBfs.
8. Set the IDR Quantize factor to match your designated medium.
9. Process your audio.

Chapter 3 – Controls and Interface



3.1 Global Limiter Section



This section consists of controls that globally affect all of the L3-16's bands.

Threshold/Input Meter

- Range -30dB to 0dB
- Default 0dB

Threshold is probably the most important control of the L3-16, as it sets the global limiting threshold as the reference threshold for all 16 bands. Once set, any signal that goes above the threshold is limited, and gain is automatically made up by the same factor; i.e., if Threshold is set to -6dB, then automatic makeup gain will accordingly be 6dB.

The Threshold fader is located on the Input Meter, allowing easy adjustment with reference to input energy. Note that the Input Meter displays the signal level after the Paragraphic EQ processing to allow accurate Threshold setting. Below the Input Meter, you will find Waves standard peak indicators. Click the peak indicator field to reset.

Out Ceiling/Output Meter

- **Range** -30dB to 0dB
- **Default** 0dB

The Out Ceiling fader sets maximum output level, scaling the output signal to reach the out ceiling value but not exceed it.

The Out Ceiling fader is located on the Output Meter. Below the Output Meter are Waves standard peak indicators. Click the peak indicator field to reset.

Threshold/Out Ceiling Link

The  button lets you adjust the Threshold and the Out Ceiling faders simultaneously, allowing threshold setting changes while monitoring the limiter effect without its makeup gain action.

Attenuation Meter

- **Range** -30dB to 0dB

The Attenuation Meter displays the overall (wideband) attenuation.

Release

- **Range** x0.1 to x10.0
- **Default** x1.0

The Release value is a multiplier for the L3-16's internal release time constants, as set by the Release Character. It proportionately shortens or lengthens each band's release values; lower values result in shorter release times; higher values result in longer release times.

Release Character

The Release Character menu contains factory settings for L3-16's ARC™ (Auto Release Control) engine, controlling limiter release behavior across the 16 bands. We strongly recommend that you experiment with the different types, as they offer a wide variety of flavors that significantly affect the sound.

Release Characters:

- Default
- Warm Analog
- Warm Classical
- Overall Punch
- Drums Punch

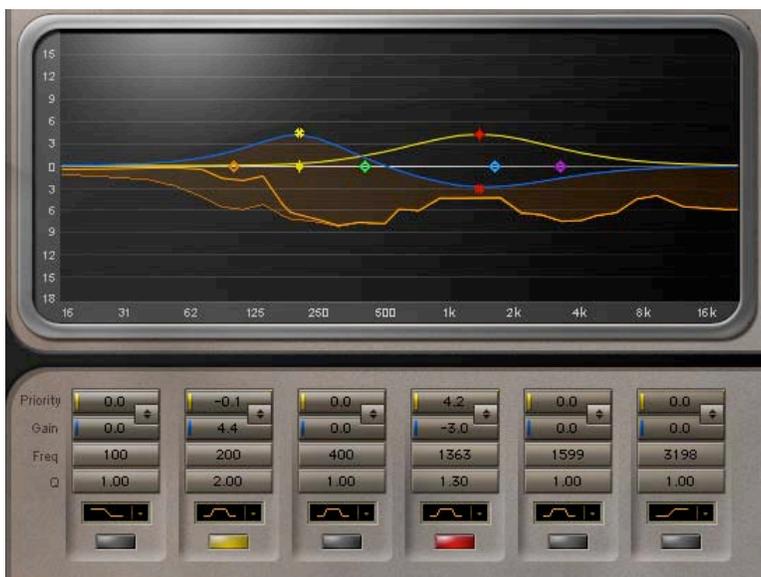
Vocal Priority 1
 Vocal Priority 2
 Bass Priority 1
 Bass Priority 2
 Hi-mid Suppressor 1
 Hi-mid Suppressor 2
 Lo-mid Suppressor
 Sub Suppressor
 L3 – Basic Profile
 L3 – Extreme Analog
 L3 – Semi Separated
 L3 – WideBand ARC
 L3 – WideBand Manual
 L3 – Warm & Cosy
 L3 – Loud & Proud
 L3 – Lean & Mean
 L3 – Low Level Loudness

Separation

- Range Low, Medium, High
- Default Medium

The Separation menu sets the Q for the multiband network crossover filters, determining the amount of overlap between bands.

3.2 Paragraphic EQ/Priority Display and Controls Section



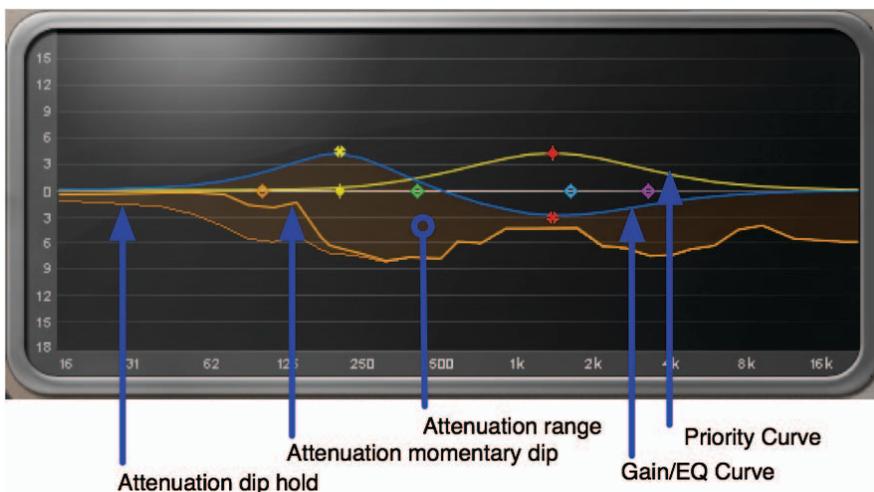
This section consists of the main display and controls for the Paragraphic EQ and Priority curves.

The interface consists of 6 Paraphrastic bands with controls for Gain, Frequency, Q, and Priority. Gain and Priority can be adjusted independently, or together, using the Link control. These Paraphrastic bands are superimposed over the 16 internal crossover bands. Each of the 6 Paraphrastic bands can be controlled by direct numerical entry into value windows, or by using the graphic display band markers.

To use these controls effectively, you need some understanding of the L3-16's internal logic. Like a wideband limiter, the L3-16 applies attenuation only when the threshold is exceeded; unlike a wideband limiter, it does not apply the same amount of attenuation over the whole spectrum. Rather, it applies more attenuation to bands that contain signals with higher peaks. This creates less inter-modulation distortion, and retains more detail from the input signal.

The L3-16 Paraphrastic EQ is applied before the limiter. This means that raising a band's Gain against the limiter's threshold results in more limiting being applied to that band. Priority allows you to control the amount of limiting applied to each band. Higher Priority results in less limiting (in relation to other bands), while lower Priority results in more limiting. Typically, Gain and Priority controls are adjusted together using the Link control, so that the Priority creates the necessary headroom for Gain to take place. However, it's important to note that controlling the Gain and Priority separately can actually lead to very interesting and widely diverse sonic results.

Main Display



The main display features 6 pairs of band markers for Priority (yellow), Gain/EQ (blue), and DynamicLine™ attenuation (orange), with a slow decaying dip hold shade across the spectrum. Note that the 0dB DynamicLine™ attenuation reference is the Gain/EQ curve, which displays the actual attenuation at each frequency.

The band markers allow direct editing of the Priority and Gain/EQ curves. Each marker represents one band of a traditional Paraphrastic EQ, and can perform a range of functions for extensive parameter adjustment straight from the display -

- **Click-vertical drag** changes gain or priority

- **Click-horizontal drag** changes frequency
- **Control-click (PC)/Command-click (Mac) and drag** constrains movement to the X or Y axis – vertical drag will lock frequency but allow gain change, and horizontal drag will lock gain but allow frequency change
- **Alt-click (PC)/Option-click (Mac) and horizontal drag** allows Q adjustment, and disables the vertical axis while held
- **Double click** on any band marker to toggle in or out
- **Drag** on any de-activated band marker to activate it
- **Shift-click** to select multiple band markers for simultaneous control; shift-click again on any marker you wish to de-select

Paragraphic EQ/Priority Controls



Note: Each Paragraphic band has controls for Gain, Freq, Q, and Priority. The Link control allows simultaneous adjustment of the Gain and Priority controls.

Priority

- **Range** -18dB to +18dB
- **Default** 0dB

Priority adjusts the relative limiting, or relative attenuation distribution, across the bands. Raising Priority applies less attenuation to the respective bands (in relation to other bands) while maintaining the same overall limiting; lowering Priority results in more attenuation applied to the respective bands. It's important to remember that Priority settings are **RELATIVE** between bands. This means that if all bands are set to the same non-zero priority, it has the same effect as setting all priorities to 0.

Gain

- **Range** -18dB to +18dB
- **Default** 0dB

Gain controls the gain of each Paragraphic EQ band. The linear phase Paragraphic EQ is placed in front of the limiter. Increasing gain may cause the affected range to go harder into the limiter threshold, subjecting it to more limiting. To boost the gain of a given range without over-limiting it, raise both Priority and Gain.

Gain/Priority Link

The  button allows simultaneous control of Gain and Priority retaining a constant offset between them.

Freq

- **Range** 16Hz to 21357 kHz
- **Default** 100, 200, 400, 800, 1600, 3200

The Freq control sets the frequency for each of the 6 Paragraphic bands.

Q

- **Range** 0.50 to 2.0
- **Default** 1.0

Adjusts Q for each of the 6 Paragraphic bands. The higher the Q setting, the narrower the range of frequencies that is affected.

Filter Type



- **Range** Bell, Low Shelf, High Shelf
- **Default** 1st band - Low Shelf, Bands 2-5 – Bell, 6th band – High Shelf

Selects the filter type for each of the 6 Paragraphic bands. The selected type is indicated by an icon representing the filter curve.

In/Out



Click the control to switch a Paragraphic band in or out (on/off). When a band is on, its control will illuminate with the corresponding color of the band marker.

3.3 IDR™ Section



Quantize

- **Range** 24, 22, 20, 18, 16 bit
- **Default** 24

The Quantize control sets the target bit depth of the L3-16 output. Quantize is always active, so the output of the L3-16 will be quantized to a maximum of 24-bits even if you are in a floating point environment.

Dither

- **Range** Type 1, Type 2, None
- **Default** Type 1

Type 1 is “purist” dithering, designed for no modulation noise at low levels. IDR™ Type 1 is optimized for use at every processing stage, allowing for the effects of cascading and subsequent signal processing. Type 1 is also optimized to generate minimal side effects when used with stereo signals.

Type 2 is designed to minimize the amount of added noise. It delivers a lower noise level than Type 1 at the expense of some low level distortion. Type2 is "auto-blackening" with no input signal. In other words, if the input signal is digital black (no signal at all) there is no Type2 dither added to the output signal.

Shaping

- **Range** Normal, Moderate, Ultra, None
- **Default** Normal

The Shaping control selects the type of noise shaping filter that will be applied to the dither and/or quantization noise. Noise shaping transfers the noise energy toward the higher, less audible range of the frequency spectrum. Selecting None leaves the noise unfiltered.

IDR Active Indicator



Whenever Dither or Noise Shaping are engaged, the IDR status indicator will be colored red to indicate activity in the IDR section. When both Type and Shaping are set to None, the IDR logo will turn gray to indicate that IDR is disengaged. The output is still rounded according to the Quantize bit depth chosen.

3.4 WaveSystem Toolbar

Use the bar at the top of the plugin to save and load presets, compare settings, undo and redo steps, and resize the plugin. To learn more, click the icon at the upper-right corner of the window and open the WaveSystem Guide.

Appendix A – Controls List

Control	Range	Default
Threshold/Input Meter	-30dB to 0dB	0dB
Out Ceiling/Output Meter	-30dB to 0dB	0dB
Attenuation Meter	-30dB to 0dB	
Release	x0.1 to x10.0	x1.0
Separation	Low, Medium, High	Medium
Release Character	Default Warm Analog Warm Classical Overall Punch Drums Punch Vocal Priority 1 Vocal Priority 2 Bass Priority 1 Bass Priority 2 Hi-mid Suppressor 1 Hi-mid Suppressor 2 Lo-mid Suppressor Sub Suppressor L3 – Basic Profile L3 – Extreme Analog L3 – Semi Separated L3 – WideBand ARC L3 – WideBand Manual L3 – Warm & Cosy L3 – Loud & Proud L3 – Lean & Mean L3 – Low Level Loudness	Default
Priority	-18dB to +18dB	0dB
Gain	-18dB to +18dB	0dB
Freq	16Hz to 20kHz	100, 200, 400, 800, 1600, 3200
Q	0.50 to 2.0	1.0
Filter Type	Bell, Low Shelf, High Shelf	1 st band - Low Shelf, Bands 2-5 – Bell, 6 th band – High Shelf
In/Out	In, out	out
Quantize	24, 22, 20, 18, 16 bit	24bit
Dither	Type 1, Type 2, None	Type 1
Shaping	Normal, Moderate, Ultra, None	Normal

Appendix B - IDR™ In Depth

Dithering and Noise Shaping

Dithering and Noise Shaping are two independent, complementary techniques that improve the perceived quality of digital audio after it has been re-quantized. Each technique is responsible for the improvement of a different subjective quality of the noise caused by re-quantization.

Dithering alters the character of the quantization noise to more closely resemble analog hiss, rather than digital quantization noise. The main effect of dithering is to reduce or eliminate all correlation between the quantization noise and the original signal, thus minimizing the non-linear distortion effects typical of digital quantization noise. The dithering process replaces the non-linear distortion sound with steadier, less displeasing analog-hiss type noise.

Noise Shaping psycho-acoustically optimizes the distribution of overall noise energy across the spectrum, by taking into account the frequency ranges to which the ear is most sensitive. Noise Shaping decreases noise level in the 1-6 kHz range, a range to which the ear is sensitive, while increasing noise level in the frequency range above 15 kHz to which the ear is less sensitive.

In short, dithering and noise shaping work by modifying the character and frequency content of noise, making it less displeasing to our ears.

Here's how Dithering and Noise Shaping help maintain 3 more bits of detail: Our brains are capable of perceiving details that are lower than the noise floor. Since quantization noise is correlated to the signal, it effectively masks the signal. Dithering breaks this correlation by inserting random signals, allowing our brain to distinguish signal from noise and thus perceive low level details. Noise shaping adds even more detail by shifting noise to a less audible range, away from the desired signal.

IDR™ Dither Options

Type1

Type 1 is a wide-band dither. Type1 adds a certain amount of noise, causing a 5dB increase in background noise. It completely eliminates low-level distortion and signal-dependent modulation effects. The result is a very transparent and clean low-level sound with a high resolution. It most resembles the steady low-level hiss of an excellent quality analog system with no digital quantization noise.

Type1 delivers no nonlinear distortion or modulation noise at low levels, and generates minimal side effects when used with stereo signals. It is the recommended choice for high quality mastering applications. By combining level maximization and IDR™ processing, 16-bit audio created from 20 or 24-bit masters have an apparent resolution of 19 bits. This is an improvement of more than 18dB.

Finally, unlike other dithering engines that are designed for single-stage CD mastering, IDR™ Type 1 is optimized for use at every processing stage, allowing for subsequent signal processing.

Type2

Type 2 is a narrow-band dither which adds a minimal the amount of noise. It delivers a noise level about 5dB lower than Type 1, while adding some low level distortion. (The distortion level is lower than when no dithering is applied.)

IDR™ Noise Shaping Options

As explained above, noise shaping shifts the noise to the frequency ranges where we hear it the least. The three Noise Shaping options provided by the IDR™ system differ in the amount of this shifting. IDR™ features ninth-order Noise Shaping filter for optimal sound quality.

Moderate

This setting typically reduces perceived hiss (or distortion, if dither is not used) by around 6dB. The added high frequency noise is about 9dB at 44.1 kHz sampling rate.

Normal

This setting typically reduces perceived hiss (or distortion, if dither is not used) by around 12dB. The added high frequency noise is about 15dB at 44.1 kHz sampling rate. This setting, together with Type1 dithering, is well suited to the creation of CD production masters. It is also good for masters that may be processed again for any reason, including consecutive re-dithering, as its accumulated noise effect is minimal.

Ultra

This setting delivers the greatest perceived hiss/distortion reduction, typically around 18dB. The added high frequency noise is about 23dB at 44.1 kHz sampling rate. This setting is suitable only at the very last stage of mastering high resolution audio for high-quality digital media (16-bit and longer wordlengths). Ultra is best suited for the final stage of preparing production masters, and should be avoided in cases where the audio will undergo further editing.

Here are some recommended IDR™ settings:

- For CD-mastering, Type 1 dithering with Normal noise shaping
- For minimum noise, Type2 dithering with Ultra noise shaping
- For maximum resolution, Type1 dithering with Ultra noise shaping