

PE-40

4-Channel Parametric Equalizer

& Creative Saturation Shaper



USER MANUAL

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1. Introduction

The PE-40 is a heavily modified 4-channel parametric equalizer inspired by classic hardware units including the **Tascam PE-40**, **Boss PQ-50**, and **Rupert Neve** parametric designs. While it draws from these legendary EQs, the PE-40 goes far beyond traditional equalization.

This plugin is designed to serve dual purposes: as a **precision parametric EQ** for surgical frequency shaping, and as a **creative saturation/distortion shaper** for experimental sound design. The extensive global controls including eight drive algorithms, tempo-synced LFO modulation, and global EQ scaling transform the PE-40 into a powerful tool for adding movement, character, and harmonic complexity to any source.

Whether you're making subtle tonal adjustments, adding analog-style warmth, creating rhythmic filter sweeps, or designing aggressive distortion effects, the PE-40 delivers professional results with an intuitive, flexible workflow.

2. Key Features

2.1 Precision EQ

- **4 Independent EQ Channels:** Each with 4-band fully parametric EQ (Low, Lo-Mid, Hi-Mid, High)
- **Wide Q Range:** 0.3 to 15.0 for everything from broad musical curves to surgical notches
- **Switchable HPF with 6 options:** Off, 30Hz 18dB, 60Hz 18dB, 80Hz 12dB, 100Hz 18dB, 160Hz 6dB
- **Switchable LPF with 6 options:** Off, 18kHz 6dB, 15kHz 12dB, 10kHz 12dB, 8kHz 18dB, 5kHz 18dB
- **Zero Latency:** Efficient biquad implementation with no processing delay

2.2 Creative Saturation & Modulation

- **8 Drive Algorithms:** Mackie, Tube, Cubic, Diode, Transistor, Warm, Hard Clip, and Soft Saturation
- **Drive Amount Control:** Scale saturation intensity from 0-200% across all channels
- **Tempo-Synced LFO:** Modulate EQ gain or frequency parameters in sync with your DAW
- **Global EQ Scaling:** Scale all gains (0-200%) and shift all frequencies (down one octave to normal)

2.3 Flexible Architecture

- **Flexible Routing:** Cascade channels or run in parallel with automatic topology sorting
- **Multiple Output Modes:** Output any single channel or sum all four with automatic gain compensation
- **Dry/Wet Mix:** Quadratic-curve blend for musical parallel processing

3. User Interface

The PE-40 interface is organized into four identical channel strips plus a comprehensive global control section. Each channel operates independently with its own EQ, filters, and gain staging, while global controls provide master saturation, modulation, and output options.

3.1 Channel Strip Overview

Each of the four channels (CH1-CH4) contains:

- EQ In/Bypass switch
- Input and Output trim controls with drive saturation
- 4-band parametric EQ (Low, Lo-Mid, Hi-Mid, High)
- High-pass and low-pass filter selectors
- Input source selector for routing

3.2 Global Section

The global section is where the PE-40's creative capabilities shine. These controls transform the plugin from a standard EQ into a powerful sound design tool:

- **Output Src:** Select which channel(s) to output
- **Drive Type:** Choose from 8 saturation algorithms
- **Drive Amount:** Scale saturation intensity (0-200%)
- **EQ Gain:** Multiply all EQ band gains (0-200%)
- **EQ Freq /2:** Shift all frequencies down (0% = octave down, 100% = normal)
- **EQ Scale Band:** Target which EQ band(s) are affected by EQ Gain and EQ Freq scaling (All, Lo, Lo-Mid, Hi-Mid, Hi)
- **LFO Target:** Select modulation destination
- **LFO Sync:** Tempo sync rate (1/1 to 1/32)
- **LFO Depth:** Modulation intensity (-100% to +100%)
- **Bass:** Low shelf EQ at 120Hz (± 15 dB)
- **Treble:** High shelf EQ at 3500Hz (± 15 dB)
- **Mix:** Dry/wet blend
- **Master:** Final output level

4. Channel Controls

Each channel provides identical controls. The following sections detail each parameter.

4.1 Input/Output Section

Parameter	Range	Default	Description
EQ In	Off/On	On	Enables or bypasses the entire EQ chain for this channel
Input	-40 to +40 dB	0 dB	Input trim with drive saturation. Higher values increase harmonic content.
Output	-40 to +40 dB	0 dB	Output trim with drive saturation. Use to compensate for EQ boost/cut.
Input Src	Host / CH Out	Varies	Select input source: Host (DAW) or output from another channel. Each channel offers three other channels as sources (e.g. CH1: Host/CH2/CH3/CH4 Out). Default routing is daisy-chain: CH1←Host, CH2←CH1, CH3←CH2, CH4←CH3.

4.2 Parametric EQ Bands

Each channel features four fully parametric EQ bands using peak/bell filter topology. All gains and frequencies are affected by the global EQ Gain and EQ Freq /2 scaling controls.

Low Band

Parameter	Range	Default	Description
Lo Gain	-15 to +15 dB	0 dB	Boost or cut at the low frequency
Lo Freq	20 - 800 Hz	200 Hz	Center frequency for low band
Lo Q	0.3 - 15.0	1.0	Bandwidth control (higher = narrower)

Lo-Mid Band

Parameter	Range	Default	Description
Lo-Mid Gain	-15 to +15 dB	0 dB	Boost or cut at the lo-mid frequency
Lo-Mid Freq	125 - 4000 Hz	800 Hz	Center frequency for lo-mid band
Lo-Mid Q	0.3 - 15.0	1.0	Bandwidth control (higher = narrower)

Hi-Mid Band

Parameter	Range	Default	Description
Hi-Mid Gain	-15 to +15 dB	0 dB	Boost or cut at the hi-mid frequency
Hi-Mid Freq	500 - 10000 Hz	2500 Hz	Center frequency for hi-mid band
Hi-Mid Q	0.3 - 15.0	1.0	Bandwidth control (higher = narrower)

High Band

Parameter	Range	Default	Description
Hi Gain	-15 to +15 dB	0 dB	Boost or cut at the high frequency
Hi Freq	800 - 20000 Hz	6000 Hz	Center frequency for high band
Hi Q	0.3 - 15.0	1.0	Bandwidth control (higher = narrower)

4.3 Filter Section

Each channel includes switchable high-pass and low-pass filters. These are fixed-frequency filters that operate independently of the parametric EQ bands and are not affected by global frequency scaling.

High-Pass Filter (HP)

Setting	Description
Off	High-pass filter bypassed
30Hz 18dB	18 dB/octave high-pass at 30 Hz - subsonic rumble removal
60Hz 18dB	18 dB/octave high-pass at 60 Hz - steep roll-off for removing subsonic content
80Hz 12dB	12 dB/octave high-pass at 80 Hz
100Hz 18dB	18 dB/octave high-pass at 100 Hz
160Hz 6dB	6 dB/octave high-pass at 160 Hz - gentle roll-off for thinning low end

Low-Pass Filter (LP)

Setting	Description
Off	Low-pass filter bypassed
18kHz 6dB	6 dB/octave low-pass at 18 kHz - subtle air taming
15kHz 12dB	12 dB/octave Butterworth low-pass at 15 kHz - classic console LPF
10kHz 12dB	12 dB/octave low-pass at 10 kHz - tape-like darkening
8kHz 18dB	18 dB/octave low-pass at 8 kHz - aggressive darkening
5kHz 18dB	18 dB/octave low-pass at 5 kHz - lo-fi / telephone effect

5. Global Controls

The global controls are central to the PE-40's creative capabilities. These parameters affect all four channels simultaneously and provide extensive options for saturation, modulation, and output configuration.

5.1 Output Source

Setting	Description
CH1-CH4	Output only the selected channel
Sum	Mix all four channel outputs with automatic -12dB (± 4) gain compensation

5.2 Drive Section

The drive section controls the saturation character applied at each channel's input and output stages. This is where the PE-40 transforms from a clean EQ into a powerful saturation/distortion tool.

Parameter	Range	Default	Description
Drive Type	8 algorithms	Mackie	Selects the saturation algorithm (see Section 8 for details)
Drive Amount	0 - 200%	100%	Scales drive intensity. 0% = minimal saturation, 200% = aggressive drive

5.3 EQ Scaling

These controls provide powerful global manipulation of all EQ bands simultaneously. Perfect for automation, A/B comparison, and creative frequency shifting.

Parameter	Range	Default	Description
EQ Gain	0 - 200%	100%	Multiplies all EQ band gains. 0% = flat response, 200% = doubled boosts/cuts
EQ Freq /2	0 - 100%	100%	Frequency scaling. 0% = all frequencies halved (octave down), 100% = normal
EQ Scale Band	All / Lo / Lo-Mid / Hi-Mid / Hi	All	Selects which EQ band(s) are affected by the EQ Gain and EQ Freq /2 scaling controls. "All" scales every band; selecting a single band isolates scaling to that band only.

5.4 Output Section

Parameter	Range	Default	Description
Bass	-15 to +15dB	0 dB	Low shelf at 120Hz (JP-8000 style)
Treble	-15 to +15dB	0 dB	High shelf at 3500Hz (JP-8000 style)
Mix	0 - 100%	100%	Dry/wet blend using quadratic curve for musical low-blend resolution
Master	-24 to +24 dB	0 dB	Final output level control

6. LFO Modulation

The PE-40 includes a tempo-synchronized LFO that can modulate various EQ parameters, adding rhythmic movement and animation to your sound. The LFO generates a sine wave and syncs to your DAW's transport, making it perfect for everything from subtle movement to dramatic filter sweeps.

6.1 LFO Parameters

Parameter	Range	Default	Description
LFO Target	Off / Various	Off	Select which parameter(s) the LFO modulates
LFO Sync	1/1 to 1/32	1/4	Tempo sync division for LFO rate
LFO Depth	-100% to +100%	0%	Modulation intensity and direction

6.2 LFO Targets

The LFO can target gain or frequency parameters across all bands or individual bands:

Target	Description
Off	LFO disabled
All Gain	Modulates gain of all 4 EQ bands simultaneously (± 15 dB at 100% depth)
All Freq	Modulates frequency of all 4 EQ bands (± 1 octave at 100% depth)
Lo Gain	Modulates only the Low band gain
Lo Freq	Modulates only the Low band frequency
Lo-Mid Gain	Modulates only the Lo-Mid band gain
Lo-Mid Freq	Modulates only the Lo-Mid band frequency
Hi-Mid Gain	Modulates only the Hi-Mid band gain
Hi-Mid Freq	Modulates only the Hi-Mid band frequency
Hi Gain	Modulates only the High band gain
Hi Freq	Modulates only the High band frequency
Drive Amount	Modulates the global Drive Amount parameter (0-200% range)
EQ Gain	Modulates the global EQ Gain scaling (affects all bands)
EQ Freq /2	Modulates the global EQ Frequency scaling (± 1 octave)

6.3 LFO Sync Rates

Setting	Note Value	Beats per Cycle
4/1	4 bars	16 beats
2/1	2 bars	8 beats
1/1	Whole note	4 beats
1/2	Half note	2 beats
1/4	Quarter note	1 beat
1/8	Eighth note	1/2 beat
1/16	Sixteenth note	1/4 beat
1/32	Thirty-second note	1/8 beat
1/4T	Quarter triplet	2/3 beat
1/8T	Eighth triplet	1/3 beat
1/16T	Sixteenth triplet	1/6 beat
1/4D	Dotted quarter	1.5 beats
1/8D	Dotted eighth	3/4 beat
1/16D	Dotted sixteenth	3/8 beat

7. Routing & Signal Flow

The PE-40 features a flexible routing system that allows channels to be cascaded or configured in various topologies. The plugin uses topological sorting to automatically determine the correct processing order and prevent circular dependencies.

7.1 Default Daisy-Chain Configuration

By default, channels are configured in a serial (daisy-chain) arrangement:

Host → CH1 → CH2 → CH3 → CH4 → Output

This mirrors the typical workflow of classic hardware EQ chains, where each channel processes the output of the previous one.

7.2 Input Source Options

Each channel can select its input source from:

- **Host:** Direct input from the DAW (parallel processing)
- **CH Out:** Output from another channel (serial/cascade processing)

7.3 Processing Order

The plugin automatically calculates the correct processing order using topological sorting. This ensures that any channel receiving input from another channel is always processed after its source channel. If you create a circular dependency (e.g., CH1 → CH2 → CH1), the plugin will fall back to the default order.

7.4 Per-Channel Signal Flow

Input → Input Trim + Drive → HPF → EQ Bands → LPF → Output Trim + Drive → Output

8. Drive Algorithms

The PE-40 offers eight distinct saturation algorithms, each with its own character. The drive is applied at both the input and output stages of each channel, with the intensity controlled by the trim amount and global Drive Amount parameter. This dual-stage saturation design allows for complex harmonic shaping from subtle warmth to aggressive distortion.

Algorithm	Description
Mackie	Console-style saturation inspired by classic Mackie mixers. Features tanh-based soft clipping with subtle analog ripple at high levels. Excellent for mix glue and warmth.
Tube	Triode tube emulation (Koren model) with asymmetric response. Adds even harmonics and warmth characteristic of vacuum tube preamps. Great for vocals and bass.
Cubic	Smooth polynomial soft clipper producing primarily odd harmonics. Musical and predictable. Excellent for adding density without harshness.
Diode	Asymmetric diode clipper emulating germanium and silicon diodes. Creates pedal-style overdrive with rich harmonic content. Try with HPF engaged.
Transistor	Solid-state transistor saturation with smooth compression characteristics. Transparent at low drive settings with graceful transition into saturation as drive increases.
Warm	Harmonic saturation with asymmetric response for even harmonics. Intelligently blends soft tanh at low drive with harder clipping at high drive. Tube-like character with musical progression.
Hard Clip	Digital hard clipping, creates aggressive distortion with strong odd harmonics. Use sparingly for lo-fi or aggressive effects.
Soft Sat	Gentle saturation curve. Very subtle compression and warmth. Great for transparent bus processing.

Notes on DC Blocking

Asymmetric algorithms (Tube, Diode, Warm) include automatic DC blocking to prevent DC offset buildup. This ensures clean, centered audio output even with asymmetric harmonic generation.

Drive Amount Interaction

All algorithms respond to the Drive Amount parameter (0-200%), which scales their intensity. Input and Output trim controls also contribute drive scaling, allowing for flexible gain staging and saturation intensity control.

9. Complete Parameter Reference

This section provides a complete reference of all automatable parameters in the PE-40.

9.1 Per-Channel Parameters (×4)

The following parameters are repeated for each of the four channels (CH1-CH4):

Parameter	Range	Default	Notes
EQ In	Off/On	On	Bypass switch
Input	-40 to +40 dB	0 dB	With drive
Output	-40 to +40 dB	0 dB	With drive
Lo Gain	-15 to +15 dB	0 dB	Scaled by global
Lo Freq	20 - 800 Hz	200 Hz	Scaled by global
Lo Q	0.3 - 15.0	1.0	
Lo-Mid Gain	-15 to +15 dB	0 dB	Scaled by global
Lo-Mid Freq	125 - 4000 Hz	800 Hz	Scaled by global
Lo-Mid Q	0.3 - 15.0	1.0	
Hi-Mid Gain	-15 to +15 dB	0 dB	Scaled by global
Hi-Mid Freq	500 - 10000 Hz	2500 Hz	Scaled by global
Hi-Mid Q	0.3 - 15.0	1.0	
Hi Gain	-15 to +15 dB	0 dB	Scaled by global
Hi Freq	800 - 20000 Hz	6000 Hz	Scaled by global
Hi Q	0.3 - 15.0	1.0	
HP	Off/30Hz/60Hz/80Hz/100Hz/160Hz	Off	Fixed frequency
LP	Off/18kHz/15kHz/10kHz/8kHz/5kHz	Off	Fixed frequency
Input Src	Host / CH Out	Varies	Routing

9.2 Global Parameters

Parameter	Range	Default	Notes
Output Src	CH1-4/Sum	CH4	Output select
Drive Type	8 algorithms	Mackie	See Section 8
Drive Amount	0 - 200%	100%	Scales drive
EQ Gain	0 - 200%	100%	Scales all gains
EQ Freq /2	0 - 100%	100%	Scales all freqs
EQ Scale Band	5 options	All	Band targeting
LFO Target	14 options	Off	See Section 6
LFO Sync	1/1 to 1/32	1/4	Tempo sync
LFO Depth	-100 to +100%	0%	Mod intensity
Bass	-15 to +15 dB	0 dB	120Hz shelf
Treble	-15 to +15 dB	0 dB	3500Hz shelf
Mix	0 - 100%	100%	Dry/wet blend
Master	-24 to +24 dB	0 dB	Final output

10. Tips & Tricks

10.1 Traditional EQ Processing

- Default daisy-chain routing (CH1→CH2→CH3→CH4) for cumulative EQ shaping
- Apply broad strokes on early channels, surgical cuts on later channels
- Keep Drive Amount at 100% and use modest input levels for clean EQ

10.2 Creative Saturation Shaping

- Push input stages hard (+20 to +40 dB) then compensate with output
- Use different drive algorithms on cascaded channels for complex harmonics
- Try Diode or Hard Clip with high Drive Amount for aggressive distortion
- Use the Mix control to parallel blend clean and saturated signals

10.3 Drive Algorithm Sweet Spots

- **Mackie:** Best for general mix glue. Try +6 to +12 dB input with compensating
- **Tube:** Excellent on vocals and bass, the asymmetry adds warmth and presence
- **Soft Sat:** Transparent bus processing. Can push harder without obvious distortion
- **Diode:** Lo-fi character on drums. Try with the HPF engaged to prevent mud

10.4 LFO & Modulation Effects

- **Filter Sweeps:** Use Hi Freq target with higher depth for auto-wah type effects
- **Rhythmic Pumping:** All Gain target at 1/4 or 1/8 creates sidechain-like movement
- **Formant Animation:** Modulate multiple bands with different LFO settings across cascaded channels

10.5 Global Scaling Techniques

- **A/B Comparisons:** Set EQ Gain to 0% to compare processed vs. flat response
- **Frequency Shifting:** Use EQ Freq /2 to shift all frequencies down an octave
- **Intensity Control:** Automate EQ Gain for builds/drops
- **Parallel Processing:** Set channels to Host input, Output to Sum, use Mix to blend

10.6 CPU Optimization

- Disable unused channels with EQ In = Off to save processing
- The plugin only recalculates filter coefficients when parameters change
- LFO modulation requires per-block coefficient updates, disable when not needed

Support

For technical support, updates, and additional information:

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