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Classic Amp Sims - VST3 Plugin Manual

Version 1.0

*** This document is incomplete and subject to change ***

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Classic Amp Sims VST3 is a tube guitar amplifier plugin for VST3-compatible digital audio workstations. It runs the same circuit-level simulation engine as the standalone and batch versions, with a custom amp-panel-style GUI. The plugin processes a mono amp signal chain followed by mono cabinet IR and optional stereo room reverb. On a stereo output, the cab signal is duplicated to both channels (or split into true stereo by a stereo reverb IR if loaded).

Amp Models:

- X59 12AY7 preamp, 6L6 power, GZ34 rectifier
- X45 12AX7 preamp, KT66 power, GZ34 rectifier
- X62 12AX7 preamp, KT66 power, GZ34 rectifier
- X87 12AX7 preamp, EL34 power, SS rectifier

Tested Hosts (Windows):

- REAPER 7
- Cubase Pro 15
- Samplitude Pro X8 Suite

*** IMPORTANT: READ "MODEL LOUDNESS DIFFERENCES" BEFORE PLAYING ***

*** The X87 Bright channel can be 20-25 dB louder than the X59 Normal ***

*** Start with low output / monitor levels, then increase. ***

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INSTALLATION

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Windows:

Copy the entire "Classic Amp Sims.vst3" folder (it is a folder/bundle, not a single file) into your system VST3 directory:

C:\Program Files\Common Files\VST3\

Or your user VST3 directory:

C:\Users\<you>\AppData\Local\Programs\Common\VST3\

Then rescan plugins in your DAW.

Classic Amp Sims ships as a single 64-bit (x86_64) build. There is no 32-bit version. The plugin is statically linked against the simulation core; no additional runtime libraries are required.

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HOST SETUP

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Once installed, "Classic Amp Sims" appears in your DAW's plugin browser under FX / Instrument-Effect / Insert plugins (depending on the host).

Bus Configurations upon starting:

The plugin negotiates the following I/O configurations with the host:

mono in -> mono out (basic guitar track)

mono in -> stereo out (recommended: enables stereo reverb)

stereo in -> stereo out (only the LEFT input channel is processed)

For best results with the optional room reverb, insert the plugin on a stereo track or stereo bus. The amp chain itself remains mono; only the reverb stage produces stereo width.

Inserting on a Track:

Place Classic Amp Sims insert effect on your guitar track.

The plugin expects a guitar-level DI signal (typically tens to a few hundred mV peak). If your DAW track is recorded too hot or too quiet, use the INPUT knob (described below) to compensate before the amp simulation.

Latency:

The plugin reports zero internal processing latency to the host. The only latency you will observe is your DAW's audio buffer size, the same as any other VST3 effect. The simulation runs at 4x oversampling (e.g. 176.4 kHz internal for a 44.1 kHz session rate) without adding delay. It runs at 2x oversampling for a 88.2 kHz session rate.

CPU Usage:

Expect CPU usage similar to a high-quality convolution reverb. The X87 on Bright Hi at high gain is the most CPU-intensive configuration. If you experience dropouts, try raising your DAW's audio buffer size. Dropouts can also be caused by too hot of a signal going into the power amp (Red Drive LED).

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GUI LAYOUT

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The GUI is 800x500 pixels at 100% size. Five zoom levels are available via the SIZE button or right-click:
75% / 100% / 125% / 150% / 200%.



Tooltips:

Hover over a few (not all) controls for a brief tooltip describing what it does. Tooltips are enabled in all hosts that support them.

Editable Value Readouts:

The number under each knob is an editable text field. Click on it, type a value, and press Enter to set the parameter exactly. For OUTPUT this is the actual gain multiplier (e.g. type "1.0" for unity); for all other knobs it is the normalized 0-1 value. Ctl + left-click mouse -> Default value.

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AMP MODEL (Top-right segment buttons)

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Click x59 / x45 / x62 / x87 to switch amp models. Each model represents a different real-world tube amplifier circuit:

- x59 12AY7 preamp, 6L6 power, ~40 W
- x45 12AX7 preamp, KT66 power, ~30 W
- x62 12AX7 preamp, KT66 power, ~30 W
- x87 12AX7 preamp, EL34 power, ~50 W

When you switch models, the plugin briefly fades audio out, re-initializes the circuit (the simulator solves each stage's DC operating point and then runs two seconds of zero-input samples through the full chain so that every coupling capacitor, cathode bypass cap, and feedback-loop state variable settles to its steady-state bias before the first note is processed), and fades back in. Total transition is roughly 100 ms. This prevents clicks and pops.

See the SIGNAL_PATH_OVERVIEW.txt document for a detailed engineering description of how the four models differ in component values and tube types.

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INPUT JACK (Dropdown below the title bar)

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These selections model the four-jack, two-channel front panel of the original amplifier:

Normal Hi Standard Normal channel input, full level

Normal Lo Normal channel, -6 dB pad

Bright Hi Standard Bright channel input, full level

Bright Lo Bright channel, -6 dB pad

B->N Jump Guitar in Bright Hi, patch from Bright Lo to Normal Hi

(Bright is primary; Normal adds body)

N->B Jump Guitar in Normal Hi, patch from Normal Lo to Bright Hi

(Normal is primary; Bright adds sparkle)

Y-Cable Guitar split equally to both Hi jacks

(Maximum gain, balanced blend of both channels)

In the jumpered modes, both channel volume controls (NORMAL and BRIGHT) act as a two-channel mixer. The Y-Cable mode is the loudest and most aggressive setting. The Bright channel has a small "bright cap" capacitor across the volume pot which produces a treble boost at lower volume settings. The size of this cap differs between models -- see BRIGHT CAP MOD below.

MAIN KNOBS



INPUT (default 0.10):

Pre-amp input scaling. The entire tube amp simulation works in real circuit voltages, milliVolts to hundreds of Volts. The default 0.10 maps a full-scale digital signal (± 1.0 in your DAW) to ± 100 mV at the guitar jack -- the level of a typical single coil DI signal. Increase if your guitar track is quiet (humbuckers may need 0.05; weaker single coils may benefit from 0.15-0.20). Decrease if the amp is overloading badly even with the volume knobs turned down -- this means your DAW's recorded signal is hotter than a typical guitar DI.

INPUT is a VST3-only parameter (parameter tag 100); it does not exist in the original amp circuit. The "0 dB = 100 mV" reference on the input meter assumes INPUT is at its default 0.10.

NORMAL (Normal Vol, default 0.50):

Volume control for the Normal channel (V1a triode). Has audio taper. Active in any jack mode that uses the Normal channel.

BRIGHT (Bright Vol, default 0.50):

Volume control for the Bright channel (V1b triode). Has audio taper. Active in any jack mode that uses the Bright channel.

BASS / MIDS / TREBLE (default 0.50 each):

Classic passive three-band (bass/mid/treble) tonestack, the same topology used in many American and British tube guitar amps of the era. These controls are interactive -- changing one affects the others. The tonestack attenuates the signal by roughly 20-30 dB at typical settings, which is why these amps need so many gain stages.

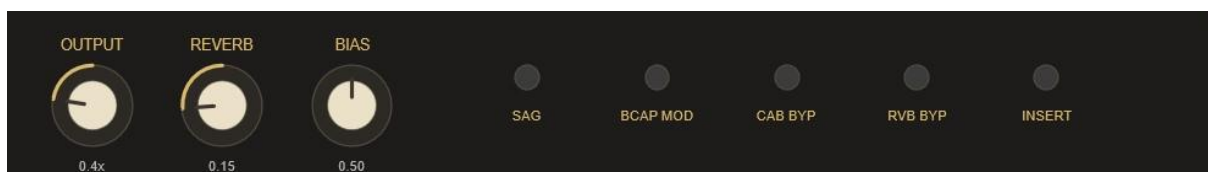
PRESENCE (default 0.50):

Located in the power amp's negative feedback path. Higher presence settings reduce high-frequency feedback, boosting upper-mid and treble emphasis in the power amp's response. Distinct from the tonestack TREBLE control, which acts before the phase inverter.

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SECONDARY CONTROLS

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OUTPUT (default 0.4x = knob position 0.20):

Master output level. The 0-1 knob range maps to a 0-2x gain multiplier:

knob 0.0 -> silence

knob 0.2 -> 0.4x (default; comfortable level for most settings)

knob 0.5 -> 1.0x (unity)

knob 1.0 -> 2.0x (+6 dB over unity)

The editable value readout shows the actual multiplier (e.g. "0.4x"), not the knob position. Type a value to set it directly.

Per-model output calibration is applied automatically inside the core so that all-knobs-dimed output peaks at approximately -3 dBFS for any model. With OUTPUT at default 0.4x, moderate settings land at about -12 to -14 dBFS regardless of which model you select.

REVERB (Reverb Mix, default 0.30 when an IR is loaded):

Reverb wet level. Behavior depends on the INSERT switch:

Send mode (default, INSERT off):

$$\text{output} = \text{dry} + (\text{wet} * \text{mix})$$

Dry signal stays at full level; wet is added on top. This matches the behavior of a real amp's reverb send loop -- the mix knob adds reverb without reducing the dry signal.

Insert mode (INSERT on):

$$\text{output} = \text{wet} * \text{mix}$$

No dry path. The mix knob acts as a level control on the reverb-only output. Use this with stereo room IRs that already contain the dry signal (cab+room IRs). With no reverb IR loaded, this control has no effect.

BIAS (default 0.50 = -48 V):

Adjusts the DC operating point of the push-pull power tubes. The 0-1 range maps linearly to a grid bias of -52 V (cold) to -44 V (hot):

Cold (knob 0.0, -52 V):

Tubes conduct less at idle. More crossover distortion at the zero crossing. Leaner, more aggressive sound. Less power dissipation.

Middle (knob 0.5, -48 V):

Default. Balanced clean headroom and warmth.

Hot (knob 1.0, -44 V):

Tubes conduct more, approaching Class A operation. Richer, grittier harmonic content. Smoother distortion. More power dissipation.

The effect is subtle and is most noticeable at overdriven settings.

BIAS primarily changes the character and harmonic content of the distortion, not the overall volume.

SAG (toggle, default OFF):

Engages the dynamic power supply model. With SAG off, the B+ rail is perfectly stiff (matching LTspice reference simulations). With SAG on, the supply voltage droops when the power tubes draw heavy current and recovers during quieter passages. This produces:

- Natural dynamic compression (3-4 dB on GZ34 rectifier models)
- "Bloom" effect -- notes swell as the supply recovers
- Touch sensitivity -- harder playing compresses more

The X59, X45, and X62 use GZ34 tube rectifiers and show strong sag.

The X87 uses a solid-state rectifier and shows much less sag (~10 V swing, less than 1 dB compression).

The B+ value on the diagnostics line shows the live supply voltage in real time. With SAG off, B+ stays equal to the nominal value. With SAG on and the amp being driven hard, watch B+ swing downward.

BCAP MOD (Bright Cap Mod, toggle, default OFF):

Swaps the bright channel capacitor (C5) with an alternate value, a common real-world modification:

Model	Stock	Mod	Effect
x59	100 pF	250 pF	Brighter (more treble boost)
x45	100 pF	250 pF	Brighter
x62	100 pF	500 pF	Brighter
x87	5000 pF	500 pF	Darker (less treble boost)

The X87's stock 5 nF bright cap is widely considered too bright by many guitarists. The 500 pF mod brings the X87 closer in brightness to the other models. For X59/X45/X62, the mod increases the cap value to add more treble.

Toggling BCAP MOD triggers a brief audio fade and circuit re-initialize (same as switching models). The mod resets to stock when you change the amp model.

CAB BYP (Cabinet IR Bypass, toggle, default OFF):

Bypasses the cabinet impulse response stage. Use this when you want to apply your own cab sim plugin downstream in the DAW.

The amp output without a cab IR is harsh and thin -- it represents the raw signal at the output transformer secondary, before any speaker filtering. This is normally not how you'd listen to a guitar amp; the cab IR is essential for a usable tone.

RVB BYP (Reverb Bypass, toggle, default OFF):

Bypasses the reverb stage entirely, even if a reverb IR is loaded.

INSERT (Reverb Mode, toggle, default OFF = Send):

Switches the reverb between Send and Insert modes (see REVERB above for the formulas). Hover the switch for a tooltip explaining the use cases.

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CABINET IR

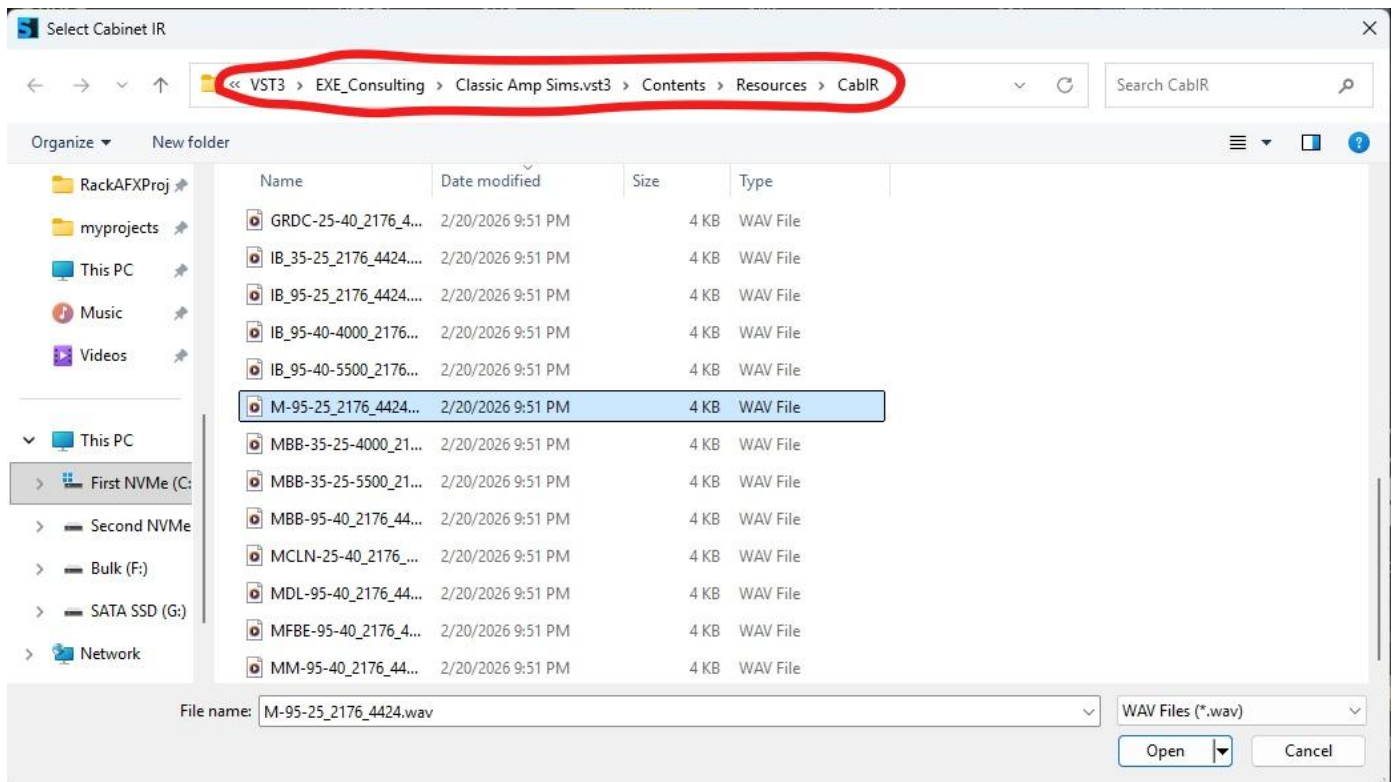
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After the amp circuit, the signal passes through a cabinet impulse response (IR) convolver. Without it, the raw circuit output sounds harsh and thin -- as it would if you tapped the signal directly off the output transformer. With a good cab IR, the result sounds like a recorded amp through a microphone.

Loading an IR:

Click "Load..." in the Cab IR row. A file browser opens. Select a WAV file containing your cabinet impulse response.



Classic Amp Sims is shipped as a bundle that includes Cab IRs in *folder*:

"Classic Amp Sims.vst3\Contents\Resources\CabIR"

The plugin itself is located as the *file* "Classic Amp Sims.vst3" inside
folder "Classic Amp Sims.vst3" :

"Classic Amp Sims.vst3\Contents\x86_64-win\Classic Amp Sims.vst3"

which would be found at FOR EXAMPLE:

"C:\Program Files\Common Files\VST3\EXE_Consulting"

Beware that there are two items named "Classic Amp Sims.vst3"

IR Format:

- WAV format (PCM, any bit depth, any sample rate)
- Mono or stereo (only the left channel is used for the cab stage)
- Typical cabinet IRs are 512–2048 samples (roughly 10–40 ms for 48,000 Samples/sec)
- The IR is automatically resampled to the host sample rate
- All Cab IRs are normalized to unity energy ($\sqrt{\sum(h[i]^2)} = 1$) so that loading or switching IRs does not produce a volume jump

Default IR:

A built-in cabinet IR is used until you load your own. The label reads "(default)" when this is the case.

Bypass:

The CAB BYP toggle skips the cab stage entirely. Use this when chaining a dedicated cab sim plugin after Classic Amp Sims.

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REVERB IR

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An optional convolution reverb runs after the cab IR. Load any room or hall impulse response WAV file via the Reverb "Load..." button.

Stereo Operation:

On a stereo output, a stereo reverb IR produces stereo room reverb from the mono amp signal. A mono reverb IR is duplicated to both channels (dual mono).

Send vs Insert Mode (INSERT toggle):

SEND mode (INSERT off, default):

Use this with conventional room or hall IRs that contain ONLY the reflections of the room (not the dry source). The dry cab signal stays at full level; the reverb is added on top. The REVERB knob acts like a wet send level.

INSERT mode (INSERT on):

Use this with stereo cab+room IRs that already contain the dry cabinet response (e.g. a cabinet recorded at a specific position in a room, capturing both direct sound and room reflections). In Insert mode, the dry path is removed and the output is wet-only.

The REVERB knob acts as a level control on the IR output.

Typical Insert workflow:

1. Engage CAB BYP to remove the cab IR (the reverb IR contains its own cab response).
2. Load the cab+room IR in the Reverb slot.
3. Toggle INSERT on.
4. Set REVERB to taste (often around 0.5 to 1.0 for unity).

Default Mix:

When you load a reverb IR for the first time, the REVERB knob is set to 0.30 (30%) automatically. You can adjust to taste afterward.

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GUI SIZE / ZOOM

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The plugin GUI supports five discrete zoom levels: 75%, 100%, 125%, 150%, and 200%. There are two ways to change it:

1. SIZE button:

Click the SIZE button (top of the GUI, between RESET and the amp model selector). A popup menu appears showing all five sizes; the current size has a check mark. Click any size to switch.

2. Right-click in almost any unclaimed and unoccupied region on the panel:

Right-clicking opens the same menu as the SIZE button. Both methods are equivalent. The right-click works on almost any blank area of the GUI panel (not on a specific control).

The chosen size persists with the plugin state (saved in your DAW session) and is restored when you reopen the editor.

Host Compatibility Note:

All tested hosts (REAPER, Cubase, Samplitude) honor the resize request and grow their embedding window to match. If a host fails to honor the resize, the plugin automatically reverts to the previous size after ~250 ms so you never see a clipped GUI.

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PRESETS

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Classic Amp Sims uses your DAW's native preset system. Save and recall presets through your host's plugin preset interface (the dropdown at the top of the plugin window in most DAWs).

Saved State Includes:

- All 17 amp parameters (model, jack, knobs, switches)
- Input level (VST3-only parameter)
- GUI zoom factor
- Cab IR file path
- Reverb IR file path

Notes on State Compatibility:

- The cab and reverb IR file paths are stored as absolute paths. If you move IR files between machines, the paths must still resolve, or the plugin will fall back to the default cab IR and no reverb.
- Plugin state from before 24 March 2026 may be ~6 dB louder when reloaded. The OUTPUT volume knob was extended from 0-1x to 0-2x gain on that date, so an old saved value of 1.0 (which used to mean unity) now means 2.0x. If a recalled session sounds twice as loud as expected, nudge the OUTPUT knob down by half.

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ABOUT PANEL

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EXE CONS

Click the small "EXE CONSULTING" text in the lower-right corner of the GUI to open the About panel. It displays the plugin version, credits, and copyright information.



Click the close button (or click outside the panel, depending on host to dismiss it.

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RESET BUTTON

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Click RESET in the top bar to restore all parameters and settings to their factory defaults. This includes:

- All 17 amp parameters reset to default values
- Input level reset to 0.10
- Cab IR cleared (returns to default built-in IR)
- Reverb IR cleared (no reverb)
- GUI size and amp model are NOT reset

RESET triggers a brief audio fade and circuit re-initialize.

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MODEL LOUDNESS DIFFERENCES -- PLEASE READ

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These four amplifiers have very different gain structures. The loudness difference between models can be dramatic, especially on the Bright channel. In a DAW context this is less dangerous than in standalone mode (your DAW limiter or master output keeps you safe), but you should still be aware of it before A/B-ing models at high monitor levels.

The quietest configuration is the X59 on either channel. The loudest is the X87 on Bright Hi with the stock 5000 pF bright cap across the volume pot. Switching directly between these two can produce a 20-25 dB level jump at the preamp output.

This is not a bug -- it is real amplifier physics, verified against independent LTspice SPICE simulations of the same circuits.

Why the X87 Bright channel is so much louder:

1. Tube gain: X87 uses 12AX7 ($\mu=100$) vs X59's 12AY7 ($\mu=44$). Worth roughly 7 dB by itself.
2. Bright cap: X87's stock C5 is 5000 pF vs 100 pF on the others. This 50x larger cap effectively bypasses the volume pot at audio frequencies, keeping the signal level high even at moderate volume settings.
3. Cathode circuit: X87 has separate cathodes for V1a/V1b, while X59 uses a shared cathode that causes partial signal cancellation between the two channels.

Per-model output calibration in the core compresses these preamp-level differences down to about a 5-7 dB final-output spread, but it is still audible. The plugin's meter strip shows the actual output level so you can see this in real time. In addition, the meter strip shows:

- Input meter: green/yellow/red bar, calibrated to GUITAR reference
(0 dB = 100 mV); -3 dB yellow, +4 dB red
- Drive LED: tri-color (green/yellow/red) showing phase inverter plate stress where red indicates clipping into the power amp
- Output meter: digital full-scale reference (0 dB = digital FS)



Suggested OUTPUT settings when starting out:

Model / Channel	OUTPUT (multiplier)
X59 Normal or Bright	0.4x (default)
X45 / X62 Normal	0.4x
X45 / X62 Bright Hi	0.3x
X87 Normal Hi	0.3x
X87 Bright Hi (loudest)	0.2x
X87 Bright Hi + BCAP MOD	0.3x

These are conservative starting points. Adjust to taste once you know the levels for your monitor setup.

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TROUBLESHOOTING

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No sound:

- Confirm the plugin is enabled (not bypassed) on the track.
- Confirm the track is unmuted and audible in your DAW's mixer.
- Check the input meter on the GUI. If it shows no activity, the plugin isn't receiving audio from the host. Check your track's audio routing.
- Check the output meter. If the input has signal but the output does not, the OUTPUT knob may be at zero. Default is 0.4x.

- If you have RVB BYP off and INSERT on with no reverb IR loaded, the output will be wet-only and silent. Toggle INSERT off, or load a reverb IR.

Distorted / clipping output:

- Lower the OUTPUT knob (try 0.2x or lower).
- Lower the INPUT knob if your DAW track is hot.
- Lower the NORMAL or BRIGHT channel volume.
- The X87 on Bright Hi has roughly 13 dB more gain than the X59 at the same knob settings -- you may need different OUTPUT values for different models.
- Engage BCAP MOD on the X87 to tame the bright channel.

CPU dropouts / xruns:

- Raise your DAW's audio buffer size (typical: 256, 512, or 1024 samples).
- The X87 on Bright Hi at high gain is the most CPU-intensive configuration. Consider switching to Normal channel or a quieter model for tracking, then re-rendering with the heavier setting offline if needed.
- Disable other plugins on the same track temporarily to confirm Classic Amp Sims is the actual bottleneck.

GUI looks clipped after resize:

- All tested hosts honor the resize correctly. If you encounter a host that does not, the plugin reverts to the previous size automatically within 250 ms. If you see persistent clipping of the GUI in a host not listed in the TESTED HOSTS section, please report it.

Stereo image collapses to mono:

- The amp chain is mono by design. To get stereo width, you need a STEREO reverb IR loaded in the Reverb slot. A mono reverb IR will be duplicated to both channels (dual mono).
- Make sure the plugin is on a stereo track or stereo bus, not a mono track.

Saved session is louder than expected:

- Sessions saved before 24 March 2026 may play back ~6 dB louder.

Reduce the OUTPUT knob to compensate. See PRESETS section above.

Plugin doesn't appear in DAW after install:

- Confirm the .vst3 bundle is in the correct directory (see INSTALLATION above).
- Trigger a plugin rescan in your DAW.
- Check that the .vst3 is a folder (bundle), not a single file. The Windows VST3 bundle has Contents/x86_64-win/ inside it.

CREDITS / TECHNICAL

Classic Amp Sims is a circuit-level tube amplifier simulation. Every resistor, capacitor, and tube in the signal path is solved as a real circuit element using Modified Nodal Analysis and Newton-Raphson iteration -- the same mathematical methods used in SPICE circuit simulators.

Tube models are Ayumi curve fits derived from measured tube data, including grid current.

Internal processing runs at 4x oversampling (176.4 kHz at a 44.1 kHz session rate) to capture nonlinear tube clipping harmonics without aliasing, and 2x for 88.2 or 96 kHz.

Phase inverter topology: Kuehnel 2019 (grid through presence control to AC ground).

Component values: based on factory schematics and Richard Kuehnel, "Circuit Analysis of a Legendary Tube Amplifier: The Fender Bassman 5F6-A" (3rd edition, 2019).

Suggested references for circuit simulation:

Andrei Vladimirescu. The SPICE Book. Wiley, 1994.

Jiri Vlach and Kishore Singhal. Computer Methods for Circuit Analysis and Design. Van Nostrand Reinhold, 1983.

Lawrence T. Pillage, Ron Rohrer, and Chandramouli Visweswariah. Electronic Circuit and System Simulation Methods. McGraw-Hill, 1995.

Ibrahim Hajj. Computational Methods in Circuit Simulation. Hajj, 2016.

Farid N. Najm. Circuit Simulation. Wiley / IEEE, 2010.

Other:

Merlin Blencowe. Designing Tube Preamps for Guitar and Bass. Second edition, Web Publishing, 2012.

For a detailed engineering description of the signal path, see [Signal_Path_Overview.txt](#) .

Classic Amp Sims is developed by EXE Consulting.