R52 BAXANDALL

NEGATIVE FEEDBACK TONE CONTROL

User Guide

Version 1.1

PULSAR MODULAR

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PREFACE

I wasn't trying to build another tone control.

I wanted to hear the sound Peter Baxandall described in his published work: not a later interpretation, not a modernized version, and not simply the familiar shape of a Baxandall curve. My aim was to understand what the circuit truly did when built and operated exactly as Peter specified. That became the foundation of R52 Baxandall.

We studied the published circuit, its component values, its feedback arrangement, and the surrounding signal-chain conditions that shape its behavior, then modeled those elements as one connected system rather than an isolated filter.

The guiding question was what Peter heard in his laboratory, and it drove every decision that followed: the amplification sits inside the EQ rather than after it, the tubes in both circuits are modeled rather than approximated, and LOAD exists because he could not have heard this circuit without an amplifier and a loudspeaker on the end of it. What comes out is the wide and wild tone shaping of the network, together with the way its amplifier and feedback respond as the signal passes through.

In 1952 those conditions were fixed by whatever hardware you owned. R52 puts them under your fingers, which widens what the circuit can do without altering the circuit itself.

R52 is a revival, not a revision. Peter Baxandall published the design in *Wireless World* in October 1952, and what began on those pages became one of the most influential circuits in audio. Yet, the industry adopted only its shape, redrawing the circuit to fit commercial realities rather than the conditions Peter specified.

Three quarters of a century later, we returned to the source, rebuilding the circuit and the conditions that defined it. This is that circuit.

Ziad Sidawi
Pulsar Modular

PART I · STARTING

CHAPTER ONE

WHAT R52 IS

R52 is a faithful reconstruction of Peter Baxandall's original 1952 two-knob negative feedback tone control, preserved exactly as he designed it.

BASS and TREBLE are the original 1952 controls, and on most material they are all you need. They are two arms of one network rather than independent bands, so they interact. Raising one changes what the other is working against. Lifting both produces a third shape. They are deliberately broad, made for shaping the character and balance of a sound rather than chasing individual frequencies.

The tube is not sitting after the EQ as a separate color stage. It is part of the circuit that creates the EQ response, so input level changes more than loudness: it changes the sound of the move itself. INPUT therefore does more than set gain. It determines how hard the tube is working.

At normal levels, the circuit stays relatively clean and low in distortion. Push INPUT higher and the tube adds progressively more color. There is no separate clean mode or saturation switch, because there is no separate saturation stage to bypass. Lower input is cleaner; higher input is more colored. INPUT lets you choose where the sound sits between those two conditions

SHELF chooses between the two treble behaviors Baxandall published for the 1952 circuit, from a lift that keeps climbing to one that bends into a shelf. In the 1957 network only the counterclockwise end is his, and there the dial acts as a top-end control in its own right. SOURCE selects what feeds the EQ; LOAD represents the amplifier and loudspeaker at the far end. These were facts of a 1952 installation, and R52 puts them under your fingers without changing the underlying circuit.

R52 also extends the original into a modern instrument. Baxandall's design was mono. R52 runs on mono and stereo tracks, with one modeled tube circuit per channel. Surround and immersive formats need an R52 Immersive Edition license (12.5).

1.1 What CIRCUIT Selects

CIRCUIT replaces the circuit itself. 1952: the original circuit, on the SP61 pentode. 1957: his later network, on the ECC81 double triode, as he published it. 1957 ALT: the same 1957 network, on the 1952 SP61 pentode - a Pulsar Modular pairing he never built.

1.2 Design Philosophy

R52 follows Peter Baxandall's design to the letter. Do not look for surgical Q or band controls here; Baxandall's circuit is about shaping overall character and balance, so it is neither a surgical EQ nor an EQ with a separate saturation stage. Any distortion you hear comes from the amplifier the EQ is built around.

We built R52 from Baxandall's original published work, not by cloning a commercial Baxandall-derived product or restoring a specific piece of hardware. Because he published it as a circuit design rather than a consumer product, there was never a box to restore. R52 is simply the circuit itself, exactly as Baxandall published it: a design he wrote for builders, which we have now brought to the desk.

1.3 What We Claim

The EQ curves are calculated from the circuit itself rather than approximated with standard filters, and the SCOPE draws from that same calculation. The distortion tracks level in proportion, with no threshold in between. We do not claim that R52 sounds like a particular piece of equipment - we checked it against Baxandall's published curves and measurements instead.

CHAPTER TWO

Five-Minute Walk

1. Put R52 on something broad: a full mix, drum bus, bass, acoustic guitar, vocal, or anywhere you would reach for a tone control rather than a scalpel.
2. Turn MATCH on so your first judgments are about tone, not level; turn it off when ready to commit the level change.
3. Start with BASS and TREBLE, making decisive moves and listening to the whole sound.
4. Lift BASS then TREBLE and listen to the middle. The two are arms of one network, so lifting both pushes the middle back; open SCOPE to see the curve.
5. If a large TREBLE lift gets glassy, add SHELF rather than backing off the lift.
6. Set INPUT for character. Use OUTPUT for final level, or hold SHIFT while adjusting INPUT to counter-move OUTPUT and compare drive changes at the same loudness. When AMP is active, INPUT also determines how hard the amplifier is driven.

TIP: The same applies to any comparison, including R52 against its own bypass or another EQ. Match the levels first, or you are judging loudness.

PART II · UNDERSTANDING THE CONTROLS

CHAPTER THREE

BASS AND TREBLE

BASS and TREBLE are the soul of the 1952 design. On most tracks, they are the entire session. Every other control changes how these two respond.

3.1 One Network, Not Two Bands

BASS and TREBLE are two arms of one Baxandall feedback network, so each knob moves the whole curve. Lift BASS and you add low end, and you also change the balance TREBLE works against. Boost both, and the middle region recedes, giving you that signature open, three-dimensional space that makes a mix breathe. Cut both, and the midrange steps forward with purpose.

The SCOPE makes this easier to see. The bold trace shows the combined response, while the faint traces show what BASS and TREBLE would do individually. The difference between them shows how the two controls affect the same network rather than operating as separate bands

3.2 Use Big Moves

BASS and TREBLE cover a wide range, from −1 to +1, and small changes can be difficult to judge in context. Make a clear move first, then bring it back if necessary. The controls are designed for broad tonal shaping rather than narrow corrective work.

Use R52 when you want to change the overall balance, weight, or brightness of a sound. For a narrow resonance, notch, or frequency-specific repair, use a parametric EQ instead.

3.3 What Each One Does

BASS is a shelf that keeps growing toward the bottom. In the 1952 circuit, it never fully levels off, extending below the audible range and adding weight. In the 1957 circuits, it turns over and falls away beneath the fundamentals instead, trading that extension for a defined bass hump with less low-mid buildup. That is why the same move can feel bigger in 1952 and punchier in 1957.

TREBLE reaches well beyond where a modern EQ shelf would usually stop. SHELF determines how far that lift continues.

3.4 Knob Position and Actual dB

The number below each knob shows its control position. Use it when you want to write down or recall a setting.

The help strip shows the actual dB change calculated for the circuit currently selected. That value changes with CIRCUIT, so the same knob position does not necessarily produce the same boost or cut in each voicing. The SCOPE shows the full response curve and makes the interaction between BASS and TREBLE visible.

When you move BASS, the help strip reports the shelf at two frequencies. When you move TREBLE, it reports the amount of lift and the point where the curve begins to extend downward.

NOTE: At the same knob position, 1952 produces roughly three times the treble lift of either 1957 circuit. The circuits are genuinely different, so do not transfer knob positions between voicings and expect the same result.

3.5 The Number Under the Knob

Baxandall's BASS and TREBLE controls were continuous potentiometers. R52 works the same way: turn the knob freely, or click the readout below it and enter a value directly.

The control range runs from −1 to +1. The readout also accepts thousandths for exact recall, so you can enter either the faceplate position or its equivalent numerical value. Type 0.5 or 500 and you arrive at the same setting; the readout shows +500 in either case. One exception is a bare 1, which means full travel rather than one thousandth.

3.6 The Red Dot: How Far Down Your Move Reaches

TREBLE on this circuit does not work at a fixed frequency. A small lift stays high in the spectrum. A larger one reaches into the presence range and takes the upper mids with it. The red dot in SCOPE shows where that reach currently ends.

Use it when a treble move is doing more than you intended. If you were looking for air and the dot has moved down near 2 kHz, you are boosting presence rather than air. That is often the region a vocal or snare is reacting to. Back the knob off until the dot returns to where you intended to work.

On small moves, there may be no dot at all, and the 1957 circuits need more knob travel before one appears. That tells you the treble move has not yet reached far enough down the spectrum to matter.

CHAPTER FOUR

SHELF

SHELF determines how the high end of a TREBLE lift behaves. Turn it clockwise and the lift bends into a shelf rather than continuing upward.

This can feel backward at first because clockwise softens the upper range instead of adding boost. Use it to keep the presence or air from a large TREBLE move while reducing top-octave harshness.

> **NOTE: SHELF does not work like a conventional treble control. Turning it clockwise reduces the upper-frequency extension of the TREBLE lift, changing a rising response into a flatter shelf. Clockwise means more shelving and less treble reach.**

Baxandall published both response families and suggested a switch so the builder could choose between them. R52 makes that choice continuously variable.

4.1 Published Positions and R52 Extensions

In the 1952 circuit, both ends of the SHELF control come from Baxandall's published work. Counterclockwise is his preferred rising-treble response from the October 1952 article; clockwise is the shelving alternative he published in the November correction a month later. R52 lets you move continuously between them.

In the 1957 circuit, only the counterclockwise position is published. The rest of the SHELF range is an R52 extension of that control behavior.

A new instance starts at zero, the published setting for either circuit.

4.2 What It Does to a Mix

Turn SHELF clockwise to make a TREBLE lift level off sooner. Turn it counterclockwise to let the lift extend further into the top end.

If a large TREBLE boost adds more top end than you want, turn SHELF clockwise before reducing the boost. This can retain the presence or air from the move while reducing excess brightness.

SHELF also affects the low end. As you add shelving, the top end comes down and the low end gains some weight, changing the balance of the full signal rather than only the highest frequencies. The effect is subtle in 1952 and more pronounced in the 1957 circuits, where SHELF behaves more like an overall balance control. Judge it in the full mix. If it adds more low end than you want, reduce BASS.

4.3 How SHELF Differs Between the Circuits

In the 1952 circuit, SHELF has no effect while TREBLE is flat. There is no treble lift for it to reshape, so the response remains unchanged until you raise or cut TREBLE.

In the 1957 circuits, SHELF affects the response even when TREBLE is flat. The 1957 network has its own top-end response, and the dial changes that response by several dB across its range. In practice, SHELF acts first as a top-end balance control and second as a way to reshape a TREBLE move.

If you switch to a 1957 circuit and the top end is not where you expect it, check SHELF before adjusting TREBLE.

4.4 Reading the Ends of the Dial

The ends of the dial carry small drawings of the response shape you're turning toward, and they change with CIRCUIT.

	Counterclockwise end	Clockwise end
1952	the lift keeps climbing	the lift corners into a shelf
1957	the top end standing at full height	the top shelved down

These are exactly what the SCOPE shows at each end.

CHAPTER FIVE

INPUT, OUTPUT, AND THE GLOW

INPUT controls tube saturation; OUTPUT controls final gain. They do fundamentally different work.

5.1 INPUT Is a Tone Control

Gain staging here isn't technical housekeeping; it's a creative decision. Quiet is clean. Loud is colored. At subtle levels, the circuit remains pristine and transparent. Drive INPUT hard, and the tube responds with rich harmonics, weight, and smooth transient rounding. INPUT dictates exactly where you land between pure clean and rich color.

5.2 OUTPUT

OUTPUT sits strictly at the end of the line, after all EQ shaping, network interaction, and tube drive. It alters exit volume and nothing else.

Use it to balance R52 against bypass: set the character with INPUT, bring the level back to where bypass sits with OUTPUT, then flip IN/OUT and judge tone with loudness out of the argument. MATCH automates this comparison; this is the manual version, useful against any reference, not just bypass.

5.3 Setting INPUT by Ear

Set INPUT last, after the tone move, and judge it at the level the track runs at. Hold SHIFT so loudness stays out of it, then push until the weight arrives and edges begin to round. There is no threshold to hunt for: a whisper wants a whisper’s worth of tube, a drum bus much more, and a hot INPUT is a color you chose, not an error. Lowering INPUT while SHIFT compensation holds the output level gives AMP more headroom. The change is audible in the way transients and low-frequency material open up under the same listening level.

> TIP: Hold SHIFT and drag INPUT, and OUTPUT counter-moves by the same amount, so drive changes without a loudness change. This lets you audition drive honestly - sweep INPUT with SHIFT held and you are hearing the tube alone, at a pinned level. Without the link, every drive change is also a volume change, and volume biases what you hear.

5.4 The Tone Controls Feed the Drive Too

A big treble lift colors the sound as well as brightening it: the boost works the tube as INPUT does. If a lift comes back thicker than you wanted, keep the curve and SHIFT-drag INPUT down: the tube backs off, the shape stays. Cuts come back cleaner as well as quieter. The lamps show the sum.

5.5 The Tube Lamps

The two tube lamps beside the R52 BAXANDALL label show the working level of each channel.

They are headroom meters, not distortion meters. A brighter lamp means that the channel's tube is working harder. Raising INPUT brightens it, but a large TREBLE boost can do the same because the boost also makes the tube work harder. On transient-heavy material, the lamp may flash briefly with peaks.

The lamps are independent for left and right. A source with more energy on one side will make that channel's lamp brighter. Within the same CIRCUIT, use the glow as a quick reference for how hard the tube is being driven.

5.6 Reading the Lamps Across Voicings

Each tube is metered against its own ceiling, and the two tubes differ in both available swing and harmonic character. At identical settings, 1957 ALT can show a brighter lamp than 1957 while producing less harmonic color: the SP61 pentode runs closer to its own limit, while the ECC81 triode produces more harmonic content at a lower fraction of its range.

Compare lamp brightness within the same CIRCUIT, not between circuits. A dimmer lamp can indicate the more colored sound when you compare 1957 with 1957 ALT. The lamp answers one question: how hard is this tube working in the selected circuit?

Full brightness is not a clipping warning. It means that the tube is using a large part of its available range. The tone circuit imposes no hard ceiling of its own. With AMP enabled, the amplifier stage can overload and has its own red warning lamp; see §5.7.

5.7 AMP Overload and Headroom

When AMP is active, the AMP lamp flashes red when the amplifier is overdriven. A second indicator beside the INPUT label flashes with it. These indicators appear only while AMP is active and identify amplifier overload, not input level.

Nothing in R52 turns INPUT down for you. The distortion is a choice. Lower INPUT for more headroom, or retain the drive when it serves the material. Hold SHIFT while

lowering INPUT so OUTPUT counter-moves and the output level remains stable. This makes the change in headroom easier to hear: transients have more room, and bass or low-mid material can feel less constrained without becoming quieter.

Use the red indication as a guide, then decide by ear. INPUT remains the control that sets amplifier drive.

CHAPTER SIX

SOURCE

SOURCE sets the driving impedance that feeds the tone circuit. In 1952, this wasn't an adjustable setting; it was a fixed reality of your signal chain that dictated how the tone controls responded. R52 puts that connection under your fingers, turning a hardware constraint into a creative choice.

6.1 Shaping the Character

SOURCE fundamentally alters the circuit's behavior. As you increase the impedance, you aren't just changing gain; you are reshaping how the EQ interacts with the signal. You'll hear boost and cut curves sag, bass and treble bands begin to interact more heavily, and the available treble reach diminish.

Think of it this way:

- **0 Ω to 600 Ω:** This is your clean, modern baseline. The circuit operates wide open and transparent.
- **1 kΩ to 10 kΩ: As you sweep** through this range, you'll notice the low-mid "boxiness" around 300–600 Hz gently dip away while the low-end weight stays firm. It's an effective way to get punch and clarity without reaching for an active EQ boost.
- **10 kΩ to 39 kΩ (Transient Softening):** The high frequencies begin to roll off. If you're working with snappy transients (snare hits, picked acoustic guitars, kick beaters), this softens the attack while keeping the body of the sound intact.
- **Up to 250 kΩ: This mimics** a heavily loaded signal chain, typical of vintage high-impedance gear. The output drops, transients blur, and the spectrum tilts. It's a specialized color for when you want a "worn-in" sound.

6.2 Workflow Tips

- **Set SOURCE first:** Treat it as the foundation of your sound before you reach for the BASS or TREBLE knobs. It defines how the circuit "talks" to your audio.
- **Clear the Clutter:** If a drum bus or bass track feels congested, sweep between 1 kΩ and 5 kΩ. You'll often find the "mud" disappears naturally.
- **Match Levels by Ear:** Because impedance changes will shift the perceived level, hold **Shift** while dragging **INPUT** to counter-move the **OUTPUT**. This keeps the loudness constant so you can hear the *tone* change, not just the volume.
- **Audition Instantly:** If you're on a Mac, hold **Cmd+Opt** (or **Ctrl+Alt** on Windows/Linux) to temporarily hear the 0 Ω response without moving your knob. It's the fastest way to check if your SOURCE setting is helping or just coloring the sound too much.

CHAPTER SEVEN

LOAD AND AMP

LOAD models the output side of the signal chain: the power amplifier driving a loudspeaker. SOURCE sets the impedance feeding the EQ; LOAD sets the amplifier's output impedance at the far end of the chain. In R52, it determines how tightly the amplifier controls a fixed 15 Ω loudspeaker.

In a tube amplifier, output impedance affects damping: the degree to which the amplifier controls cone motion. R52 makes that interaction available as a tonal control.

7.1 Damping and Output Impedance

The dial values are the amplifier's output impedance, not the speaker's nominal rating. R52 models a fixed 15 Ω vintage studio monitor. The LOAD setting changes the amplifier's damping factor, or how strongly it controls the speaker cone.

Lower impedance: Higher damping factor. The amplifier stops cone motion more quickly when the signal ends, producing tighter bass and more controlled transients.

Higher impedance: Lower damping factor. The cone continues moving slightly after the signal ends, producing more low-end bloom, a low-mid dip, and softer high frequencies.

7.2 The Five Load Profiles

Left-click LOAD to move forward through the profiles; right-click to move backward. The SCOPE updates in real time to show the active curve.

Setting	Modeled Condition	Sonic Character & Application
OFF	Complete bypass (Infinite damping)	Transparent and linear. Represents a modern solid-state amplifier with total cone control.
0.7 Ω	Tightest grip	Subtly dips 200 Hz and softens top-end glare.

1.5 Ω	Tight grip	Cleans up boxy low-mids, firms up the fundamental bass, and smooths out the upper registers.
2.5 Ω	Moderate-damping tube amp	A distinct hollow at 200 Hz and a shelved-down top above 10 kHz.
3.5 Ω	Low-damping character stage	Pronounced low-mid dip and audible top-end softening. Use this for aggressive tonal shaping.
7.0 Ω	Historical loose-damping profile	Maximum low-end bloom and a deep low-mid hollow. Picks up a proposal from the LS3/5A's own research report, a seven-ohm feed to extend its bass, that was published but never adopted (Chapter 22).

7.3 Workflow and Evaluation

Start at OFF: Every new instance initializes at OFF. Use it as the neutral reference before adding the character of the power stage.

Compare with OFF: Hold Cmd+Opt on macOS or Ctrl+Alt on Windows and Linux while hovering over LOAD to momentarily hear OFF without changing the selected setting. This lets you compare the contribution of the LOAD stage directly.

Match levels when needed: Higher impedance settings attenuate low mids and highs, which can change perceived loudness. Turn MATCH on when you want to compare the tone of the LOAD settings at a consistent level.

7.4 AMP: the Amplifier Behind the Speaker

LOAD gives you the loudspeaker. AMP gives you the amplifier that drives it: Baxandall's own ten-watt design from January 1948, published as the companion to the tone control, solved live as a circuit rather than printed as a curve. Switch it on and that amplifier drives LOAD's speaker in place of LOAD's fixed colour.

What it does to a mix: the low end gains dimension and the low mids grow richer, while the top stays contained on peaks instead of spreading. Against LOAD alone the bottom reads clearer, kick and bass keep more depth, and a snare's crackle finishes smoother.

AMP is the deep tier. LOAD alone is the fast colour and remains the normal path; AMP is the same idea taken to a real amplifier, and it costs real CPU. Spend it on the tracks that earn it, the bass, the drums, the low-mid body of a mix, rather than on every channel by reflex.

7.5 AMP Requirements

Operation: AMP is available only when LOAD is active. With LOAD set to OFF, the AMP button is unavailable.

Routing: In MID, SIDE, L, or R modes, LOAD remains available but AMP is bypassed.

Switching: You can toggle AMP, change LOAD settings, or turn LOAD off without clicks or pops during playback.

Automation: AMP is not automatable, on the same reasoning as MATCH. It is a configuration choice, saved in presets and the session, and it travels in the A/B slots.

7.6 AMP Lamp States

AMP lamp state	Meaning
Amber	AMP is active and running.
Purple	The session is running above 96 kHz. AMP will print in freeze, render, and export; live monitoring uses the standard LOAD path.
Red flash	AMP is being overdriven. Lower INPUT for more headroom, or retain the drive if it serves the material.

7.7 LOAD Under AMP: the Feedback Control

With AMP on, the LOAD dial stops being a fixed colour and becomes what it was on the real amplifier. Baxandall fitted a pot to set how much negative feedback the amplifier used, and the dial is that pot: 0.7 Ω is the amplifier as published, the most feedback and the tightest grip; 7.0 Ω is the least feedback, where the loudspeaker pulls harder on the amplifier, the low end takes on weight and the top rolls away.

Every step is level-matched at 1 kHz, so moving through the dial compares character rather than loudness.

One consequence is worth knowing before you go looking for it. Less feedback also means the amplifier is driven harder for the same INPUT, so at 7.0 it reaches overload at roughly a sixth of the input level 0.7 needs. That is how a feedback pot behaves rather than a fault, and INPUT is how you choose where on the amplifier's curve to sit.

7.8 AMP at High Sample Rates

AMP runs live at session rates up to 96 kHz. Above 96 kHz, the purple AMP lamp indicates that AMP is included in freeze, render, and export, while live monitoring uses the standard LOAD path. Freeze the track to hear the printed AMP result in context.

7.9 Managing AMP CPU Use

AMP uses more CPU when driven harder. Higher INPUT settings increase processing load, and opening LOAD can also increase it.

Use AMP where it makes the biggest difference, such as on bass, drums, or key buses. If a session becomes too heavy, freeze or bounce tracks with AMP enabled, then continue mixing with the rendered audio.

R52 is deterministic, so rendering the same session produces the same result every time. Offline bounces can also render cleanly even if a high-CPU setting causes glitches during real-time playback.

Set the sound first, then freeze or bounce. Keep the original track available so you can return to the AMP settings later if needed.

CHAPTER EIGHT

CIRCUIT

CIRCUIT selects the circuit and tube combination. The three positions differ more substantially than a simple filter-curve change: each has its own network behavior and harmonic character.

8.1 The Three Voicings

Two tubes appear below. The SP61 is a pentode, the type in the original 1952 circuit; the ECC81 is a double triode, the type Baxandall specified for his 1957 design. The pentode has far more gain and distorts less; that difference is most of what separates the two 1957 positions.

Position	Circuit	Tube	Character
1952	Original 1952	SP61 pentode	A broad treble shelf that keeps climbing and a bass shelf that reaches into pure weight. Reach for this when you want the instrument’s full, wide-open reach.
1957	1957 network	ECC81 triode	A redrawn network with added components. The treble acts more like presence control, and the bass turns over into a defined hump, cleaning up mud below.
1957 ALT	1957 network	SP61 pentode	Same 1957 curves on the 1952 tube. The bass hump and the presence-style treble are the 1957 network's; the pentode distorts about a third as much as the triode, so note attacks stay defined where 1957 thickens them. A Pulsar Modular pairing Baxandall never built.

8.2 Understanding the 1957 Choice

The 1957 network is Peter Baxandall's second voicing. It appeared five years after the 1952 paper, within a preamplifier design.

1957 and 1957 ALT use the same network. The difference is in density and articulation rather than EQ shape. The 1957 position uses the ECC81 triode from Baxandall's published circuit and produces roughly three times the harmonic coloration of 1957 ALT.

1957 ALT pairs the 1957 network with the SP61 pentode used in the 1952 circuit. It retains the 1957 curves while keeping the low end cleaner and note attacks more defined.

Use 1957 when you want the published 1957 circuit: fuller, thicker, and more harmonically colored.

Use 1957 ALT when the 1957 EQ shape works but bass attacks need more definition.

The tube lamps show headroom, not relative coloration, so they do not provide a direct comparison between the two circuits.

8.3 R52 Extensions and Published Circuitry

The circuits themselves are Baxandall's. R52 extends the design in two specific ways:

1952 and 1957: These networks follow the circuits published in Wireless World.

1957 ALT: This is an R52 extension that pairs the 1957 network with the SP61 pentode to provide an alternative version of the historical circuit.

The 1957 SHELF range: This is also an R52 extension. Baxandall published only the counterclockwise, earthed condition for the 1957 network.

CHAPTER NINE

IN/OUT

IN/OUT is the lamp button in the middle of the faceplate - R52's own bypass. It exists to give a fair answer to "is this instance making the mix better?"

9.1 Bypass Operation

Bypassed, R52 passes your audio through untouched - not flat settings, not a polite version of the circuit, but output equal to input, bit for bit. Active and bypassed carry exactly the same delay, so toggling never shifts the audio in time, and the switch is click-free - no pop, no dropout - so you can flip it mid-phrase rather than in a pause. With IN/OUT the only variable is whether the circuit is there.

Your host's bypass button works the same switch. R52 hands the host its IN/OUT as the plugin's own bypass, so the DAW's button, BYPASS in the top bar and IN/OUT on the faceplate always move together, and the timing stays identical. If your host bypasses plugins its own way instead, use IN/OUT.

> **NOTE: Bypass against a flat, active R52 isn't a comparison of two identical signals - passing through the circuit costs a fraction of a decibel even at rest, which is real circuit behavior, not a fault. A fraction of a decibel is enough to sway a close comparison, so judge with MATCH engaged, decide, then turn MATCH off.**

While the plugin is bypassed, the IN/OUT button breathes: a slow pulse, the same signal ISOL uses. A preset you save keeps IN/OUT, and loading it applies it, the host's bypass included: a preset saved with the unit off loads with it off, and one saved with it on switches a bypassed R52 back on. The factory presets leave IN/OUT alone, except Default, which switches the unit on; an A/B flip never changes it. The breathing is there so you notice.

PART III · WORKING WITH R52

CHAPTER TEN

MATCH

A small level increase can make a setting sound better even when the tonal change is not an improvement. This loudness bias is especially easy to misjudge with an EQ that can make large changes to the spectrum.

When MATCH is on, R52 holds sustained output loudness close to the dry input level. As you adjust BASS, TREBLE, or drive, you can evaluate the tonal change with less influence from level differences.

10.1 What MATCH Holds

MATCH targets sustained loudness, the average energy over time, rather than peak level. EQ moves also reshape transients, so your DAW's peak meter can still move while perceived loudness remains close to the dry signal. MATCH references the input before the circuit and compensates for the EQ curve and drive stage together. Raising INPUT can therefore change tube character without creating the usual loudness advantage.

10.2 How MATCH Compensates

MATCH uses the current EQ curve, the same curve shown in SCOPE, to calculate its compensation. The compensation occurs internally: the OUTPUT knob and SCOPE trace do not move. It applies the same correction to every channel, preserving the balance between them.

10.3 Committing to OUTPUT

MATCH is intended for evaluating settings. When you find a setting you want to keep, turn MATCH off. R52 transfers the current compensation to the OUTPUT control without a level jump or click.

Transition: Turning MATCH off is seamless; there is no level jump or click.

Workflow: Turn MATCH on to compare settings, then turn it off to commit the resulting output level.

Recall: Preset loads, A/B flips, and session recall follow the saved MATCH state without rewriting the OUTPUT value.

10.4 When to Leave MATCH Off

1. When level is part of the decision: If a BASS lift is intended to make a track feel bigger by adding energy, leave MATCH off so you can hear the level change as part of the result.

2. When setting final levels: With MATCH off, use your ears and meters to set the level feeding the next device, bus, or master chain.

3. Before rendering: MATCH is not automatable. If it remains on during render, its loudness compensation is printed to the file. Turn it off before the final render when you want the committed OUTPUT value to define the result.

CHAPTER ELEVEN

SCOPE

SCOPE displays the EQ response calculated from the current circuit and control settings. It is not a generic illustration: the trace represents the curve applied to the signal.

Use SCOPE when BASS and TREBLE interact in a way that is difficult to judge by ear, or when you want to identify where a move is affecting the spectrum.

11.1 Visualizing the Interaction

The bold trace shows the combined output curve. The two faint traces show the BASS and TREBLE responses individually.

The difference between the faint traces and the bold trace shows the interaction between BASS and TREBLE. Because both controls share one feedback network, moving one changes the response of the other. Use the display to identify which part of the network is affecting the area you are hearing.

11.2 FLAT: The Zeroed-Controls Trace

The FLAT toggle at the bottom left draws a dashed trace with BASS and TREBLE set to zero. It shows the contribution of SOURCE, SHELF, and LOAD on their own.

Use FLAT to compare the underlying response with the result of your BASS and TREBLE moves. The difference between the dashed trace and the bold trace is the response added by the tone controls.

11.3 The Red Dot

SCOPE marks the lowest frequency where TREBLE has moved the response 3 dB from where it sits with TREBLE flat, boost or cut, with a red dot.

The red dot is not a fixed corner frequency. As TREBLE increases, it moves lower on the frequency axis. If it reaches around 2 kHz, the adjustment is affecting the presence range as well as the upper treble.

11.4 Plot Controls and Data

Plot readout: Hover over the plot to see the frequency and dB value at that point. The value is calculated from the circuit, not read from the graphic.

Zoom: Use the ZOOM toggle at the top left to select ±24, ±12, ±6, or ±3 dB vertical scales.

Full scale: Useful for broad EQ moves.

Tight zoom: Useful for sub-decibel moves. If a large curve runs beyond the top of the window, the display scale has been exceeded; the curve continues above the visible range.

PIN: Keeps the SCOPE window above other windows when switching between R52 instances.

11.5 Meter Rail

The right side of the SCOPE window provides level information for the current instance.

Left bar (DRY or IN): Shows the input level. DRY is the signal before R52; click the label to select IN, the level after INPUT. Comparing IN with OUT shows the gain change through the tube and circuit at the current settings.

Right bar (OUT): Shows the final output level.

MATCH line: When MATCH is engaged, shows the compensation in dB used to maintain sustained loudness.

Important: These meters are RMS meters, not peak meters. They show average signal energy rather than transient peaks. Your DAW's peak meter will usually read higher, depending on the material. Use SCOPE for gain staging and balance; use the DAW meter to monitor digital headroom.

CHAPTER TWELVE

CHANNEL MODE AND ISOL

CHANNEL MODE decides which part of the stereo image this instance works on. Click to step through five positions:

Position	This instance processes
STEREO	both channels: the whole image. The default on every fresh insert
MID	the center of the image, where the vocal, kick, snare and bass usually sit
SIDE	the spread: the width, the ambience, the doubles, everything that makes stereo stereo
L	the left channel alone
R	the right channel alone

Whatever the position, the output is always the full stereo picture - the part this instance doesn't own passes through unprocessed and time-aligned, so narrowing the instance narrows what your knobs touch, not what you hear. In any component mode - MID, SIDE, L, or R - you hear the reconstructed stereo: your processing in context with the parts this instance doesn't own, not that channel alone. To hear only the component you're working on, press ISOL.

12.1 Mid/Side and Dual-Mono

A single instance can only process one part of the image at a time - you cannot run MID and SIDE, or left and right, from one instance. For Mid/Side work, run two instances: one set to MID, one to SIDE, the way you'd patch two mono units into an M/S chain. One panel carries one set of knobs because each instance gets the full instrument to itself - its own circuit, SOURCE, LOAD, drive, MATCH, SCOPE and A/B. The same pattern covers dual-mono, with one instance on L and one on R.

The mode lamp is amber when the image is whole (the default state on every R52 lamp); MID/SIDE share one color and L/R another. In MID, the working tube is labeled MID and the idle tube goes dark, since only one is doing anything.

12.2 Bus Widths

On a true mono bus the button reads MONO and doesn't cycle. On a bus wider than stereo it reads MULTI and locks, processing every channel. Wider buses need an R52 Immersive Edition license (12.5). The five positions only appear on a stereo bus. A MID, SIDE, L or R preset still loads on these buses: you get its full tone, processed the ordinary way, because there is no stereo pair to split.

12.3 MATCH and Presets in Component Modes

MATCH holds the loudness of what leaves the plugin - the recombined stereo - not just the component you are processing. A large side move is compensated on your half; the untouched half isn't disturbed.

> **NOTE: Every preset remembers its channel mode and sets it when you load it. The name tells you which: a suffix means MID, SIDE, L or R, and no suffix means the whole track. So loading an ordinary preset after a MID one puts you back on the whole track: you are never left in a mode you didn't choose.**

Saving on a mono track always gives you an ordinary preset, whatever mode the instance was in.

The startup Default never carries routing or ISOL. The mode saves with the session and is not automatable: routing is patching, not a performance move.

12.4 ISOL

ISOL is the audition button. While lit, you hear only the component this instance processes, on both speakers, with your full move applied - circuit, drive, EQ, and MATCH. The button flashes the whole time it is active.

Typical use: make a move in context, press ISOL to confirm it did what you meant on the component itself, release, and judge again in context. The component arrives at ISOL at exactly the level it has inside the recombined output, so nothing jumps when you toggle it.

ISOL is also how you route a single component to what comes next - while held on, only that component leaves the plugin. It saves and restores with the session (so a chain depending on it keeps working) it travels in a preset, and it can't be automated.

Outside a component mode, ISOL is dim and inert, but it is remembered: leave MID and come back and it is still lit. It travels in presets too, which is what makes the two-instance method in §12.1 something you can save: one preset for the MID half, one for the SIDE.

12.5 R52 Immersive Edition

Surround and immersive formats need an R52 Immersive Edition license. A Standard license runs R52 on mono and stereo tracks only.

Check your license first. Open the menu and choose License Status. The window names your edition: “Standard edition (mono and stereo)” or “Immersive edition (any channel count)”. About shows the same line.

If your host won’t offer R52 on a surround track, your license is Standard. After activating an R52 Immersive Edition license, reload the plugin or restart your host so surround tracks can see it.

On a bed, one instance processes every channel, the LFE included. The channels are linked: every one follows the same controls and one MATCH, so the balance between speakers holds. Insert R52 as one multichannel instance, not multi-mono. Separate mono instances each run their own MATCH, and the balance drifts with the program.

AMP runs on every channel of a bed, so its CPU cost grows with the channel count. Set the sound first, then freeze or bounce.

CHAPTER THIRTEEN

A/B

Beside the preset name sits a three-cell strip: A and B as a pair, and a third cell reading A ▸ B or B ▸ A. These are R52's compare slots - two temporary places for two settings, so your ears can move between them.

The live settings are always the active slot. Whatever the panel shows right now is what the lit cell holds. Flip, and the settings you are leaving are stashed while the other slot's settings take the panel.

13.1 Switching Slots

Either cell flips to the other slot - you don't have to aim at the specific one you want. The help strip announces which slot you land on and its name.

On a fresh insert, both slots hold the preset that loaded with it, so A/B never jumps to an empty or unfamiliar state. If you haven't changed anything, flipping changes nothing, since the slots match.

13.2 Copy and the Safe Workflow

The third cell copies the live slot over the other, labeled with the direction before you commit (A ▸ B while A is live, and vice versa). This turns A/B into a method: dial in a sound you trust, copy it so the trusted version is parked in the other slot, then push further - more treble, a different SHELF, harder drive, another circuit - and flip to compare. If the push is better, copy again and keep going; if not, the trusted sound is one click away.

> **NOTE: Copy has no undo, which is why the direction is always labeled before you click.**

13.3 What a Slot Carries

A slot holds the whole instance: every control that shapes what you hear, including CIRCUIT, the channel mode and ISOL. One thing never travels with it.

Never in a slot	Why
IN/OUT	a flip must never bypass the plugin, or un-bypass one you switched off on purpose

Because the mode travels, you can copy a sound to the other slot, switch one of them to MID, and flip to hear the same tone on the centre against the whole image.

13.4 Presets and the Slots

Loading a preset lands it in both slots at once, so the flip starts level and everything A/B tells you afterward is about what you did to the preset. SAVE writes the slot you are currently on. Anything you want tomorrow goes into a preset today: the slots are working storage, and a reopened session brings back what was saved, not what was parked in the other slot.

CHAPTER FOURTEEN

SESSIONS, HOSTS, AND AUTOMATION

Save the session, reopen it later, and R52 comes back exactly as you left it.

14.1 What the Session Saves

The session saves every parameter as values - the actual positions, not a reference to a preset file, so renaming, reorganizing, or deleting presets doesn't affect sessions built from them.

Per instance it also remembers the window (including its size), the SCOPE (open/closed, position, PIN, ZOOM, FLAT, and the DRY/IN meter setting), ISOL if it was active when you saved, and the preset name. The hover-help toggle is a machine setting, not session state - it applies to every R52 instance on that computer until you change it again.

14.2 A/B Starts Level

Both A/B slots come back holding the sound you saved, so the first flip lands on the same sound. Make a move, then flip to hear where you started.

14.3 Automation

Each control below appears in the host's parameter list under the name you would guess. Nothing is numbered, nothing is cryptic:

On the panel	In the host's list	Rides a lane
BASS	Bass	yes
TREBLE	Treble	yes
SHELF	Shelf	yes
SOURCE Ω	Source Ohms	yes
INPUT	Input dB	yes
OUTPUT	Output dB	yes
IN/OUT	In/Out	yes
BYPASS	Bypass	yes
LOAD	Load	yes
MATCH	Match	no
CIRCUIT	Circuit	yes
CHANNEL MODE	Channel Mode	no
AMP	Amp	no

IN/OUT is latency-matched, so nothing shifts in time when automated. CIRCUIT automates too: a change crossfades between the two circuits over about 15 milliseconds, so a step on a lane is safe mid-take. Three controls don’t automate: MATCH is for listening while you decide, not part of the final sound - automating it would move the level under everything downstream; CHANNEL MODE is routing, not something you ride mid-mix; and AMP is a configuration choice, on the same reasoning as MATCH. All three still save and restore with the session - they just don’t take an automation lane.

ISOL isn’t in the list at all: it is not a host parameter, so it can’t be switched by automation or a stray controller assignment during a render. What you hear with ISOL on is what a render prints.

14.4 Renders

Bounce normally: latency lines up on its own, and the same session rendered twice gives identical files. If two renders of a mix differ, the reason lives elsewhere in the chain.

Above 96 kHz, AMP prints in freezes, renders, and exports even though live monitoring uses the LOAD path. See Section 7.8 for the workflow.

PART IV · IN PRACTICE

CHAPTER FIFTEEN

Recipes

Every move in this chapter was made at the desk, during the listening sessions that voiced R52, and kept because it survived them. None is a setting - only a starting position and direction; the readouts make any of them exactly recallable once your ears have finished the job. Each recipe names a CIRCUIT, because the circuit decides more than any knob position does.

15.1 Punch on a Bass Without Boosting

Stay in **1952**. Leave BASS and TREBLE alone and reach for **SOURCE**: come up from 600 Ω into the low thousands.

What to listen for: the boxiness in the low mids thinning while the weight underneath holds firm. Nothing is boosted; the contrast between the two simply grows, and that reads as punch and definition. By the 10 kΩ mark the focus is still moving upward. Past it the pluck attack starts to blur, and that is the sign you have left definition and entered color. SOURCE gives up a little level as it rises, so bring the level back before you judge: loudness flatters punch.

15.2 Weight

1952, SOURCE at 600 Ω, and push **BASS** decisively. This control stays musical right up near the top of its travel, and at 600 Ω the circuit is unloaded and open.

What to listen for: richness and weight below the notes, a shelf that keeps growing under the material rather than a bump sitting on it. This is the bottomless low end the rest of this guide keeps mentioning, and it arrives clean.

15.3 Punch With a Bounce

Flip to either 1957 position and give BASS a small lift. Small is the recipe: the character is there almost immediately, well before the knob has traveled far.

What to listen for: a defined hump on the fundamentals of bass notes with the mud pulled out from underneath, punch with a soft bounce to it. The same small move in 1952

grows the whole low end instead. Flipping between the two with the lift in place is the fastest way to hear what CIRCUIT is for.

15.4 A Big Treble Lift and How It Finishes

1952, with **TREBLE** taken well up: around +0.7 is a serious lift and the dial is usable there. Then let **SHELF** choose the top. At the rising end (counterclockwise, the glyph that keeps climbing) the lift stays bright: glossy, crystal, the published sliding lift. Clockwise, the lift corners into a shelf: smoother, a touch more presence, and far less top-octave glare at the same TREBLE position.

What to listen for: hi-hats and cymbal tails. Both ends are Baxandall's own published conditions and neither is the correct one. The rising end keeps the sparkle, the shelving end trades it for ease, and with the top shelved the balance of the whole instrument reads lower. Choose the family per job, not once forever.

15.5 Keep the Top When Leaving 1952

At the same knob position, the 1957 circuits deliver roughly a third of 1952's treble lift. Flip CIRCUIT mid-session and the top reads as gone. It is not gone: the control has different authority now.

Push TREBLE further and read the dB in the help strip rather than the angle on the dial. What to listen for: the 1957 lift arrives higher up and more gently, presence rather than reach. Expect to sit noticeably further along the dial for the same felt brightness.

15.6 Compare the Circuits, Not the Drive

At equal INPUT, the 1957 circuits run their tube much harder than 1952 does, so an A/B between the eras is hearing two things at once: different curves and a harder-working tube.

To hear the networks alone, flip between 1952 and 1957 ALT, the pair that shares a tube, and trim INPUT down in 1957 ALT until the two lamps match. Neither comparison is the wrong one: equal INPUT compares the two instruments as built, equal glow compares the two tone networks. Know which question you are asking. And leave the lamps out of any judgment between the two 1957s: they read headroom, not character, and they do not compare across tubes.

15.7 Starving the Source Impedance

1952. Run SOURCE out past the 10 kΩ fence, toward 39 kΩ and beyond, and let it misbehave: attack blurs, the balance tilts, the level falls away. Then bring the level back with OUTPUT, or with INPUT if you want the tube working harder as well.

What to listen for: a different instrument at the same loudness: softer-fronted, tilted, period. Gain cannot undo a shape change, and that irreversibility is why the far side of the fence is a palette rather than a fault.

15.8 The Tighter of the Two 1957s

When the 1957 network is the right circuit but the bass is thickening, switch the tube. **1957 ALT** runs its low end about three times cleaner, so note attacks keep their articulation. **1957** thickens them and carries more color everywhere: the circuit as he published it.

What to listen for: the front of bass notes. The axis between these two is more and less, not harsher and softer. Choose based on the harmonic density the material needs.

CHAPTER SIXTEEN

Gain Staging

Internal processing is 64-bit floating point throughout, so there is no internal resolution to protect and no digital reason to stage levels into the plugin. Set INPUT for the sound you want, not for a number.

In most plugins gain staging is housekeeping. In R52 it is part of the sound, since level through this circuit is a tone decision before it is a level decision.

Control	Job	Details
INPUT	how hard the circuit is driven: a tone control	Chapter 5
OUTPUT	how loud R52 leaves: a level control, nothing else	Chapter 5
MATCH	holds your loudness steady while you decide	Chapter 10

INPUT isn't a trim in front of an EQ - the tube is inside the feedback loop, so turning INPUT turns the character. OUTPUT changes level and nothing else. Keep those two roles separate and this chapter is mostly done.

16.1 Headroom and Clipping

Push INPUT as far as the material wants. The character thickens in proportion all the way up, with no threshold where something else steps in, so a hot setting is a color you chose. R52 sets no ceiling of its own: the limit is the device after it. The OUT bar shows the level you send. Your host's peak meter shows whether the next device clips. Set OUTPUT against both.

16.2 Trading Drive Against Level

Two ways to change drive without changing loudness:

SHIFT-drag. Hold SHIFT and drag INPUT, and OUTPUT counter-moves by the same amount, so the drive changes and your loudness does not. The point of doing it this way is that both knobs move in plain sight: there is no hidden compensation anywhere in this plugin, and what the panel shows is what is being applied.

MATCH holds perceived loudness steady while you push INPUT, flip circuits, or compare against bypass, so tone wins the comparison instead of volume.

16.3 Where It Sits in a Chain

There is no required position for R52 in a chain - track, bus, or mix all work. What matters is that whatever sits ahead of it is effectively holding R52's drive knob too: raising an upstream device's output drives R52 harder, intentionally or not. Set upstream gain first, and re-check INPUT if it changes later. And make the tone decision on the level the track actually runs at, not a soloed pass at a different level.

16.4 Feeding the Next Device

Nothing touches your level except OUTPUT and MATCH's contribution when engaged - no makeup stage, no hidden correction. To judge what you are handing downstream, open SCOPE and read the meter rail: the OUT bar shows what leaves the plugin. Since tone moves carry level with them (a serious BASS lift is a louder track), check OUT after a tone move and adjust OUTPUT accordingly.

The tube lamps show how hard the circuit is working; the meter rail shows what the rest of the session receives. Gain staging in R52 is answering both on purpose.

PART V · HOW IT WORKS

CHAPTER SEVENTEEN

The Circuit and the Tubes

Two questions bring engineers to this chapter, and they are really the same question: *why does a bass move change the mids too, and why does this feel different from a parametric even when the SCOPE shows a similar curve?* The answer is where Baxandall put the network.

17.1 The EQ You Already Know

A parametric is a row of independent filters - each band reshapes its slice of the spectrum and hands the result on, with no band aware of the others. That independence is the point, and it is exactly what surgical work needs.

The classic alternative is a passive shelf pair with a makeup amplifier behind it: the network filters what passes through, and the amplifier restores the loss afterward. Different sound, same architecture - filter first, amplifier after. In both designs the amplifier sits outside the EQ, processing whatever the filtering left.

17.2 What Baxandall Did Instead

In October 1952, Baxandall put the tone network inside a one-tube amplifier's negative feedback path. The network sits between the amplifier's output and input: everything the amplifier produces comes back through the network as a report on its own output, weighed against what's arriving at the input. The amplifier drives its output continuously to keep the two in balance.

Turn a knob and you haven't filtered the signal - you've tilted the report. Where the network under-reports the output, the amplifier pushes harder (your boost); where it over-reports, the amplifier eases off (your cut). What you hear, at every setting including flat, is the amplifier's output and nothing else. The knobs change what the amplifier is asked to do, not the signal directly.

17.3 Why Bass Reaches the Mids

There is one network, not two bands. The bass and treble arms meet at the same point in the same network, so each changes what the other is working against. The SCOPE shows this: the bold trace is the one curve the circuit settles into, and the faint traces show what

each knob would produce alone. Moving BASS re-tilts one end of a single curve, which the circuit then resolves as a whole - the middle moves because it belongs to the same curve, not because of crosstalk between separate bands. This interaction can't be switched off because it isn't an implementation detail; it is the shape of the instrument.

17.4 Why the Amplifier Is Inside Every Setting

Since the feedback loop is the EQ, the amplifier is not a stage after it - it is one of the things the curve is made of. Its strength and limits sit inside every setting, which is why drive and tone are entangled here in a way they are not on a parametric. Boosting treble asks the tube to swing harder exactly where you boosted.

17.5 Why R52 Models the Amplifier

Copy the published curve into a modern filter and you have half the instrument. The shape arrives; the behavior does not. The interaction has to be faked or dropped, drive and tone come apart, and the tube becomes a separate coloring stage bolted on after: precisely the architecture Baxandall's design is not.

So R52 is built as the loop: the network solved as a circuit, with the amplifier, tube and all, sitting inside it where Baxandall put it. Not because the history deserves a museum, but because the loop is the only place the sound described in this guide actually comes from.

Your parametric	This circuit
independent bands, added together	one network, one solved curve
the filter shapes the signal	the knobs steer the amplifier
color, if any, is a stage after the EQ	the amplifier's character is inside every setting

That is the whole answer. A parametric filters the signal. This circuit tells an amplifier what to be.

Two questions come up early: why does a treble boost sound more colored as well as brighter, and where's the clipping point, since pushing harder never finds one? Both answers come from the tube and the feedback loop around it.

17.6 What a Boost Asks of the Amplifier

The tone network sits in the feedback loop around the tube, so a tone setting isn't a curve applied afterward - it is a change in what the loop demands from the tube at each frequency. Boosting treble asks the tube for more swing at those frequencies, which is where the lift comes from, and more swing carries more of the tube's character on exactly the frequencies you raised. Cutting relaxes the tube where you cut, so that region comes back cleaner as well as quieter.

Tone and drive are one system here, not an EQ followed by a saturator. If you want the same EQ shape with less character, hold SHIFT and drag INPUT down - OUTPUT counter-moves to hold loudness while the tube backs off.

17.7 Why There Is No Clipping Point

The tube's curve has no corner - it bends smoothly at every level, with distortion tracking the signal in proportion across an 80 dB range. There's no threshold to stay under and no sweet spot to hunt for; every level sits on the same smooth slope, so drive it where the music wants it. The lamps show how much of the tube's swing is in use, not a warning to avoid.

17.8 The Pentode and the Triode

CIRCUIT's two 1957 positions are one network with a choice of tube: the SP61 pentode from 1952, or the ECC81 triode Baxandall specified. Both tubes bend the same way - the difference is how much gain each brings to the loop, since gain is what the loop spends correcting the tube's own bending. The pentode brings much more gain, so the triode lets roughly three times as much of the same character through, with an identical harmonic profile.

The choice is an amount, not a kind: no smoother tube, no harsher one, just more or less of the same thing. Use 1957 to hear the network as published, color included; use 1957 ALT for the same curves with a cleaner low end.

One clarification: 1952 isn't a third point on this scale - it is a different network around the same pentode, and the network is the bigger difference. CIRCUIT replaces the circuit, not just the tube.

17.9 Which Tube the Panel Draws

Each channel’s plate carries one tube icon, following CIRCUIT. In 1952 and 1957 ALT it is the SP61’s opaque metal can; in 1957 it is the ECC81’s clear glass, showing two plate structures since an ECC81 is a double triode. Only the left plate ever lights - that’s the half in the tone loop. The right plate is the other half of the tube, which Baxandall’s 1957 preamplifier used for a plain amplifier stage R52 doesn’t model, so it is drawn but never lit.

17.10 Where the Amplifier Sits

The amplifier and LOAD both sit after the tone control, so AMP's character is the same under the 1952 circuit and under both 1957 circuits. Choosing a voicing and choosing an amplifier are separate decisions. The amplifier's forward path is normalised, so engaging AMP never flips absolute polarity.

17.11 The Pair That Was Never Perfectly Matched

The amplifier's output tubes are a 6L6G pair, and they are deliberately not perfect twins: they carry a small emission mismatch, the way a 1948 constructor's luck-matched pair would. A matched pair is strict and even. The shipped pair swings.

The mismatch is also why the amplifier's character depends on what came before it. After a loud bass passage the output transformer's core keeps a slight lean, so the amplifier treats the next hits a little differently from hits that follow silence. That program-dependent behaviour is the reason for modelling the amplifier as a circuit rather than as a curve.

CHAPTER EIGHTEEN

How It Was Checked

The preface makes a large claim: this is the circuit. Here is what that was checked against.

18.1 The Two Checks

Baxandall published response curves alongside his schematic, and those figures are R52's reference. The check ran two ways: R52's solved response was laid over his published curves point by point, and separately, the same network was given to an independent circuit simulator with no knowledge of R52's engine, and its curves were compared against R52's.

18.2 Why No Commercial Product Was Measured

No commercial product was targeted or measured. That's not restraint - there's nothing to target: no commercial unit of this circuit was ever built, mono or stereo. It lived as a published design, built by its readers. When R52 disagrees with another Baxandall-derived product, that's not a defect in either - they answer to different references. Choose between them by ear.

18.3 Check the Shape Yourself

The SCOPE draws the same solved curves the audio passes through, not an illustration. The original articles are freely available (Appendix A) - set the panel to match a published figure and compare the SCOPE's trace against the printed curve yourself.

18.4 What Listening Checked

The curves establish that the shape is his; they don't establish that the instrument is worth using, which no measurement can. That part was checked by listening, on program material, with decisions made by ear and kept. What survived those sessions is what shipped.

PART VI · HISTORY

CHAPTER NINETEEN

Malvern, October 1952

The circuit in R52 arrived in the world as a magazine article: Wireless World, October 1952, “Negative-Feedback Tone Control,” by Peter Baxandall, an engineer working at Malvern. When CIRCUIT reads 1952, that article is what’s running - the published circuit, built and operated under the conditions he specified, not a descendant or a product inspired by it.

19.1 What He Published

The ordinary tone control of the day was passive: it shaped sound by throwing signal away and relied on a separate amplifying stage to make up the loss. That stayed standard practice for years afterward. Baxandall’s October article put the tone network inside the amplifier’s feedback loop instead, so the tube was part of how the network behaved rather than cleanup after it. Flat was unity, boost and cut mirrored each other, and one stage did the whole job. The article was complete - circuit, tube, every component value, and the reasoning, including the source condition R52 now puts on a dial.

19.2 The Correction

A month later he published a correction. Most of it pinned down printed part specifications, but one item did more: the October article had drawn two families of treble curves, his preferred rising family in full lines and a shelving alternative dotted. The November correction published the arrangement that produces the shelving family.

He was clear that he preferred the rising shape but considered the question genuinely contested, and in January 1955 his next design put that choice on a front-panel switch. On R52, in 1952 mode, that argument is the SHELF dial - counterclockwise is the October article, clockwise is the November correction, and the continuous ground between them is R52’s.

As the circuit was redrawn and copied over the following decades, this tapped detail fell away - by 1974 the trade press was drawing the circuit as a bare amplifier triangle with no tube, no values, and no citation. R52 restores the choice.

19.3 Why It Spread

Nothing was sold. The circuit cost the price of the magazine, was complete enough to build straight off the page, and did in one stage what standard practice split across two.

The spread took longer than the legend suggests - the circuit didn't sweep the tube era it was born into, since passive networks stayed the norm and the famous tube preamplifiers of the time used a different feedback approach. The real conquest came with transistors and op-amps: by 1974 the same magazine was calling the configuration "the almost universal choice" of manufacturers, drawn without a source. What propagated was the article's proportion - boost and cut mirrored about unity - rather than the circuit itself, rebuilt by others in their own parts and impedances.

19.4 Baxandall's Published Record

October 1952	"Negative-Feedback Tone Control": the complete circuit, and the reasoning
November 1952	the correction, carrying the alternative shelving arrangement
January 1955	his next design puts the rising-or-shelving choice on a front-panel switch, left to the builder
May 1957	the network re-voiced, inside a preamplifier design: Chapter 20

The modern engineering canon still cites his work from as late as 1980–81, on active volume control and RIAA equalization, long after his surname had become an adjective.

He stated his preference and published the alternative anyway; he corrected his own work in print within a month; he left contested questions to the builder rather than settling them by omission. SHELF exists because he published both answers, and this guide names whose ground you are standing on because he did the same.

R52 is not affiliated with, endorsed by, or connected to Peter Baxandall or his estate. The project's entire relationship with him is the printed record, listed in Appendix A; the formal statement is in Appendix B.

CHAPTER TWENTY

1957, THE VERSION ALMOST NOBODY BUILT

The previous chapter covered a famous paper; this one covers its opposite: a circuit by the same man, in the same magazine, that went unseen for most of seventy years - the other half of the CIRCUIT button.

20.1 One Page, Under the Wrong Heading

Wireless World, May 1957, page 209, titled “Inexpensive Pre-Amplifier.” Baxandall never published a second tone-control paper, but designing this preamplifier he redrew the network with new values and a component absent from the original, so it would deliver gain instead of unity - his own second voicing, published inside someone else’s problem, which is why almost nobody has seen it.

20.2 What the Gain Bought

He wasn’t fixing the 1952 circuit - nobody had complained. Giving the tone stage gain meant the stage feeding it only had to deliver a small signal, distorting very little even without its own feedback, while the tone stage (which does have feedback) supplied the level at similarly low distortion. Very low total distortion, bought cheaply, was the point; saving a tube was secondary.

He named the price himself, in the same paragraph: reduced treble lift, and bass lift reduced too, to a lesser degree.

20.3 The Price, Named in the Same Paragraph

He states the cost right where he makes the change: the price is "a reduction in the available amount of treble lift", and bass lift is reduced too, to a lesser degree. Nobody discovered the trade later, and nobody needed to. He traded available lift for gain and lower distortion in the tone stage, said so in print, and considered it a good bargain.

20.4 What the Trade Sounds Like

Flip CIRCUIT with a treble lift dialed in and you hear the bargain immediately - the lift arrives more gently and higher up, while the bass turns over instead of running away. What he traded away stays traded away; the trade is the character.

20.5 Why It Went Unnoticed

No commercial implementation of the 1957 network has been found, and the standard literature doesn't cite the article at all - only October 1952. The reason is ordinary: the redrawn network appeared as one stage of a budget preamplifier, filed under preamplifiers, and nobody surveying tone-control designs had reason to open it. It wasn't rejected, just neglected.

20.6 How R52 Ships It

The 1957 position is the article's circuit: his second voicing with the ECC81 double triode in its loop, as published. The 1957 ALT position beside it is the same network fitted with the 1952 pentode instead. That pairing appears in no magazine. Baxandall never built it, and neither the panel nor this guide presents it as history: it is an R52 extension, kept because it widens what the instrument can do without touching the published network.

So read the button as two circuits, with a choice of tube on the later one. The history in this chapter belongs to 1952 and to 1957. ALT belongs to us.

That is the whole story. A real Baxandall, published once, filed under the wrong heading, never taken up, now sitting one click from the 1952 circuit whose shape spread everywhere. The source, if you want to read past the title yourself, is Wireless World, May 1957, page 209.

CHAPTER TWENTY-ONE

What the Industry Actually Built

You've probably used a Baxandall EQ for years, on a console or in a plugin. A fair question is whether R52 is that. It isn't, and this chapter is the record of what actually traveled out of the 1952 article.

21.1 The Shape Traveled

What spread was the article's proportion: two matched arms around an inverting amplifier, unity in the middle, boost and cut mirroring each other, shelves rising toward the band edges. Any amplifying device completes the arrangement, which is exactly why it conquered - but almost nothing else made the trip. Impedances scaled down roughly a hundred to one as tubes gave way to transistors and op-amps; capacitor choices varied by maker.

Traveled with the name	Stayed on the page
the proportion: boost and cut mirrored about unity	the component values, at their original impedance scale
shelves that keep rising toward the band edges	the SP61 pentode, and an amplifier that is part of the EQ
an inverting stage at the center; any device completes it	the stated condition on what may drive the network (Chapter 6)

By the time most of the industry built the circuit, the name had detached from the papers entirely - what propagated was the gain structure on whatever device was current.

21.2 A Name That Outran the Papers

By 1974, Wireless World itself ran "Baxandall tone control revisited" (M. V. Thomas, September 1974), which called the configuration "the almost universal choice" of manufacturers, drew it as a bare inverting triangle with no device or values, used "Baxandall" purely as an adjective, and cited neither of his papers. Twenty-two years on, the name needed no source - the largest compliment a trade pays a circuit.

The 1957 voicing never entered that stream at all - no commercial schematic copies it, and the literature doesn't cite it. The silence is specific to that circuit, not to the man: the same literature cites his later work freely, and the famous gain-bearing Baxandall circuit is his 1980 active volume control, a different design for a different job.

21.3 The Tube Era

Tube hi-fi wasn't ruled by this circuit from 1952 onward. Mullard's own flagship designs kept tone controls passive through at least 1963, and celebrated tube preamps like the Marantz 7, Dynaco PAS, and Quad 22 used a different feedback approach entirely. The circuit is near-universal reign begins with transistors and op-amps - by the time the triangle was everywhere, the tube inside it was long gone.

21.4 The Baxandall You Have Used

The tone control you know is the 1952 proportion on modern devices at modern impedances, fed from a buffer, into a light load. It behaves beautifully, which is why it is everywhere, and nothing here is a criticism of it - it kept the half of the article that survives any device. Set beside the 1952 article, the other half is this guide's subject:

The amplifier is part of the EQ. The article places the network in the negative-feedback path of an SP61 pentode, so the tube's behavior is inside every curve. Descendants keep the network but choose amplifiers whose character stays out of the way.

The source is part of the EQ. The article states a condition on what may drive the network, and the curves change when it is violated. A modern buffer satisfies that condition silently; R52 puts it on a dial.

The lift keeps climbing. The 1952 treble rises past the top octave, and R52 keeps that behavior while offering the shelving choice Baxandall himself published.

21.5 Where R52 Stands

What spread was the shape of the circuit; this is the circuit. R52 revives the network, the SP61 in its feedback loop, and the stated conditions around it, placed under your fingers rather than assumed away. It models no product in that lineage - the reference is the October 1952 article and its correction, nothing else.

CHAPTER TWENTY-TWO

Seven Ohms

This guide ends on a loudspeaker because the signal did. In 1952 nobody heard a tone control alone - the signal left Baxandall's network, picked up power in an amplifier, and reached a loudspeaker. R52 keeps both ends of that chain on the panel: SOURCE is the first, LOAD is the last.

22.1 The Little Monitor

The loudspeaker behind LOAD is the LS3/5A, the BBC's miniature monitor - a sealed box of about five liters, nominally 15 ohms, designed by the BBC's own research engineers. It is a mid-1970s design, and pairing it with a 1952 circuit is deliberate: the tone control outlived the loudspeakers of its own decade, so a monitor from later in its working life shows it through a better window.

22.2 Harwood's Remark

The LS3/5A's research report, written by Harwood, notes that its small sealed enclosure overdamps the bass unit - held at perfect grip, the low end stops sooner than it needs to. The report names two ways to extend the bass: one traded away sensitivity, and the other was to feed the loudspeaker from about seven ohms and redesign its internal network to suit. Harwood set both aside, and the LS3/5A shipped voltage-driven, held as tightly as amplifiers of the era could manage. The seven-ohm idea appears once, in prose, as a road considered and not taken.

22.3 What R52 Applies, and What It Leaves Out

LOAD's 7.0 Ω setting picks up that remark, applying half of it: the seven-ohm feed, without the network redesign Harwood paired with it, since the modeled loudspeaker is the one that actually shipped. That's why 7.0 is the boldest position on the dial - bass blooms as intended, but the rest of the balance moves further than Harwood's full proposal would have allowed.

22.4 Amplifier Ohms, Not Speaker Ohms

One misreading is worth killing here. The ohms on the LOAD dial are the amplifier’s, never the loudspeaker’s. A reader raised on 4-ohm and 8-ohm speakers will see LOAD 7.0 and read a speaker rating; it is not one. The monitor in the model is nominally 15 ohms at every position of the dial. What the dial sets is the output impedance of the amplifier holding it: how tightly it grips, and smaller is tighter.

Read the dial as the story above. **OFF** is a modern amplifier, perfect grip and no color, an exact bypass, and also the condition the LS3/5A actually shipped in. Each step up loosens the hold, moving the monitor away from how the BBC delivered it and toward how Harwood almost proposed it, until at 7.0 the amplifier holds a 15-ohm loudspeaker through nearly half the speaker's own impedance: as loose a grip as anyone of the era put on paper. Of the five steps, only that last one traces to a document. The rest are R52's working positions on the way there.

That is where this guide stops, because it is where the signal stopped: a small studio monitor, a remark in its research report about how its bass might have gone deeper, and a tone control that had already been working for a quarter of a century when the box was designed. After seven ohms there is only air.

PART VII · REFERENCE

CHAPTER TWENTY-THREE

PRESETS

23.1 Where the Files Live

Every copy of R52 on the machine reads the same shared folder:

Platform	Preset folder
macOS	/Users/Shared/Pulsar Modular/R52 Baxandall/Presets
Windows	C:\Users\Public\Documents\Pulsar Modular\R52 Baxandall\Presets
Linux	~/.local/share/Pulsar Modular/R52 Baxandall/Presets
iPad, iPhone	inside the app, shared by the plug-in and the app (27.2)

The folder is shared by every account on the machine (on Linux, each account has its own). Each preset is a single file with the extension .R52Preset.

23.2 The Folder Is the Source of Truth

The browser keeps no copy of anything. It reads the folder, to any depth, and shows what is actually there:

- **Rename a preset in the file manager and it is renamed in the browser; move one into a subfolder and it moves; make folders, nest them, reorganize the whole bank, and the browser follows. All of this is live - the browser updates while it is open, so you can tidy the bank in the file manager with R52 running and watch it happen.**

23.3 Unsaved Work

Loading a preset replaces everything on the panel, including work you haven't saved. In the browser a click loads, and so do the arrow keys, so it is easy to do by accident.

A load also lands in both A/B slots (13.4), so neither slot keeps what you had. Before you browse, save what you want to keep as a preset.

23.4 What a Preset Carries

A preset stores the sound, and whether R52 was switched in:

Stored	Which is
BASS, TREBLE, SHELF	the tone
SOURCE, LOAD	the conditions around the circuit
AMP	whether the amplifier drives LOAD's speaker
INPUT, OUTPUT	the drive, which is part of the character
CIRCUIT	the circuit itself
MATCH	whether compensation is engaged
IN/OUT	whether the unit is on (9.1)
CHANNEL MODE	where the tone lands: the whole track, or MID, SIDE, L or R
ISOL	whether the component is the plugin's output

Every preset sets both of those when you load it. A suffix on the name means MID, SIDE, L or R; no suffix means the whole track.

23.5 What a Preset Never Stores

- **A/B slots are working memory, not part of any sound. Window state - loading a tone preset never opens, moves or closes your SCOPE window.**

23.6 The Default Preset

A preset named exactly Default in the top level of the bank loads on every fresh insert. It is an ordinary file otherwise: save over it like any other, and delete it to return new inserts to the factory starting point. It is also the one preset that never carries routing or ISOL.

23.7 Deleting

Deleting a preset from the browser sends the file to the Trash (the Recycle Bin, on Windows), never into thin air, and asks first, naming the file it is about to remove. Change your mind afterward and the file is sitting where deleted files go, ready to be put back.

23.8 Backup, and Moving Between Machines

Backing up your presets means copying one folder. That is the whole procedure, and restoring means copying it back.

The files travel. A preset saved on one machine loads on another, macOS, Windows and Linux alike, so a bank can follow you between rooms or be handed to a collaborator: copy the files, drop them anywhere inside the other machine's preset folder, done.

Installing a new version of R52 leaves your preset folder exactly as you left it.

23.9 Pro Tools Preset Management

When using R52 Baxandall in Avid Pro Tools, note that Pro Tools handles plugin preset management differently from most other DAWs. To ensure R52 Baxandall's internal preset system works seamlessly with Pro Tools' own preset management, follow these steps.

Set Plugin Default Behavior

- In the plugin's header bar (top of the plugin window), open the Preset drop-down menu in Pro Tools.
- Navigate to Settings Preferences ➔ Set Plug-In Default to ➔ User Setting.

This ensures that R52 Baxandall recalls your most recent or user-defined settings instead of reverting to the factory default every time the plugin is inserted.

Save Presets to the Session Folder

- Again, open the Preset menu and go to Settings Preferences ➔ Save Plug-In Settings to ➔ Session Folder.

This ensures all custom R52 Baxandall settings are stored within the current Pro Tools session folder, rather than the global root settings directory. This is especially useful

when collaborating or moving sessions between systems, as your R52 Baxandall settings will automatically travel with the session.

> **TIP: Enabling both options allows Pro Tools and R52 Baxandall's internal preset browser to work hand in hand, ensuring consistent recall and a smooth preset workflow across sessions.**

CHAPTER TWENTY-FOUR

Installation and the First Insert

Install the format your DAW uses: the audio engine is the same code in every one.

Format	Platform	Installed at
VST3	macOS	/Library/Audio/Plug-Ins/VST3/Pulsar Modular/R52 Baxandall.vst3
VST3	Windows	C:\Program Files\Common Files\VST3\Pulsar Modular\R52 Baxandall.vst3
VST3	Linux	~/.vst3/R52 Baxandall.vst3 (the .deb links it there for each account)
AU	macOS	/Library/Audio/Plug-Ins/Components/R52 Baxandall.component
AAX	macOS	/Library/Application Support/Avid/Audio/Plug-Ins/Pulsar Modular/R52 Baxandall.aaxplugin
AAX	Windows	C:\Program Files\Common Files\Avid\Audio\Plug-Ins\Pulsar Modular\R52 Baxandall.aaxplugin
LV2	Linux	~/.lv2/R52 Baxandall.lv2 (or /usr/lib/lv2 for a system-wide install)

Updates install over the top. Run the new installer and it replaces the plugin files in place. It refreshes the factory presets unless you deselect that option; presets you saved yourself are never touched.

Your license decides which channel formats R52 offers. Check it under License Status (12.5).

24.1 Where Presets Live

R52 stores presets as ordinary files, shared by every copy of the plugin on the machine:

<shared documents>/Pulsar Modular/R52 Baxandall/Presets

Platform	Which means
macOS	/Users/Shared/Pulsar Modular/R52 Baxandall/Presets
Windows	C:\Users\Public\Documents\Pulsar Modular\R52 Baxandall\Presets
Linux	~/.local/share/Pulsar Modular/R52 Baxandall/Presets

If that shared folder isn't writable, R52 falls back to an equivalent folder in your own user area. Presets are per-machine, not per-user, so everyone on a shared studio machine sees the same bank; on Linux each account has its own.

The folder is the source of truth. Rename a preset in Finder and it's renamed in R52; drag one into a subfolder and it moves; nest folders as deep as you like. Nothing is hidden in a database, so backing up your presets is copying a folder.

24.2 What a Fresh Insert Gives You

An untouched instance is the 1952 circuit and nothing else:

Control	Fresh insert	Meaning
BASS, TREBLE	flat	no shaping
SHELF	the published position	Baxandall's own preferred condition
SOURCE	0 Ω	an ideal driver: no source impedance color
LOAD	OFF	a true bypass: nothing downstream is modeled
CIRCUIT	1952	the original circuit
INPUT, OUTPUT	0 dB	unity
MATCH	off	no compensation
CHANNEL MODE	STEREO	both channels processed

LOAD OFF is a bypass, not a gentle setting, as that stage is out of the signal path entirely.

24.3 Setting Your Own Default Preset

If you always start from the same settings, save a preset named exactly Default in the top level of the bank, and R52 loads it on every new insert. The preset browser's right-click menu offers this as "Save these settings as the startup default".

Three things to know: existing sessions are untouched, since a saved session restores its own settings and only new inserts start from your Default; it never changes routing, so new inserts always arrive in STEREO regardless of what channel mode was active when you saved the default; and delete it to go back - if the file is missing or unreadable, R52 falls back to the factory starting point.

24.4 Latency

R52 reports its latency to the host and your host compensates for it automatically, so your tracks stay aligned and you do nothing.

24.5 A First Sanity Check

Insert R52 on something you know well, leave every control alone, and toggle IN/OUT. You should hear almost nothing: at rest the network is flat and the tube is transparent at ordinary levels. What remains is a fraction of a decibel of insertion loss, which is the real circuit's behavior, not a fault.

If the two states differ by more than that, something upstream isn't what you think it is.

24.6 Linux Notes

- **R52 installs on Linux as VST3 and LV2, from a .deb package or a .tar.gz archive. Hosts read the LV2 build's parameters as plain numbers, since LV2 has no way for a plugin to supply formatted readouts, while the VST3 build reports formatted values. Chapter 28 covers installing, activating, the file locations, the hosts and performance.**

24.7 Uninstalling

On macOS, Windows and Linux your presets live inside the shared 'R52 Baxandall' folder as plain files. Copy that folder somewhere safe before deleting it if you want to keep them for a reinstall or another machine.

Windows

VST3: open 'C:\Program Files\Common Files\VST3\Pulsar Modular', locate the 'R52 Baxandall.vst3' folder and delete it.

AAX: open 'C:\Program Files\Common Files\Avid\Audio\Plug-Ins\Pulsar Modular', locate the 'R52 Baxandall.aaxplugin' folder and delete it.

Shared: open 'C:\Users\Public\Documents\Pulsar Modular', locate the 'R52 Baxandall' folder and delete it. This folder contains the user guide and presets. If no other folders exist under 'Pulsar Modular', this can be deleted as well.

macOS

AU: open '/Library/Audio/Plug-Ins/Components', locate the 'R52 Baxandall.component' file and delete it.

VST3: open '/Library/Audio/Plug-Ins/VST3/Pulsar Modular', locate the 'R52 Baxandall.vst3' file and delete it.

AAX: open '/Library/Application Support/Avid/Audio/Plug-Ins/Pulsar Modular', locate the 'R52 Baxandall.aaxplugin' folder and delete it.

Shared: open '/Users/Shared/Pulsar Modular', locate the 'R52 Baxandall' folder and delete it. This folder contains the user guide and presets. If no other folders exist under 'Pulsar Modular', this can be deleted as well.

Linux

Package (.deb): remove it with ‘sudo apt remove r52-baxandall’.

Archive (.tar.gz): run ‘./uninstall.sh’ in the folder you installed from. It removes ‘~/.vst3/R52 Baxandall.vst3’ and ‘~/.lv2/R52 Baxandall.lv2’.

Both leave your presets, settings and MIDI mappings where they are.

Shared: to remove those too, delete ‘~/.local/share/Pulsar Modular/R52 Baxandall’ (presets and the user guide), ‘~/.config/Pulsar Modular/R52 Baxandall’ (settings) and ‘~/.config/Pulsar Modular MIDI/R52 Baxandall’ (MIDI mappings).

CHAPTER TWENTY-FIVE

Technical Specifications and Performance

The figures below are the reference information most useful when planning a session.

25.1 Latency

Session rate	Latency
44.1 / 48 kHz	182 samples (about 4 ms)
88.2 / 96 kHz	142 samples (about 1.5 ms)
176.4 / 192 kHz	0 samples

R52 reports these figures to the host, enabling automatic delay compensation to keep your tracks perfectly aligned.

IN/OUT is latency-matched. Bypassed and active pass through the same delay, so toggling the button compares tone against tone rather than two different timings.

25.2 CPU Use

CPU performance varies by computer and host, so there is no single meaningful benchmark. To gauge R52's impact on your system, add instances at the settings you expect to use until playback approaches your practical limit.

R52 processes each audio channel separately. A stereo instance therefore uses roughly twice the processing of a mono instance. There are no quality modes or hidden performance settings.

AMP is the main exception: its CPU use increases when it is driven harder. Higher INPUT settings, more-open LOAD settings, and higher sample rates all increase its processing demand.

> **NOTE:** AMP is R52's most CPU-intensive option. If playback stutters, reduce INPUT, return LOAD closer to 0.7, increase the host buffer size, or freeze/bounce the track once the setting is final.

CHAPTER TWENTY-SIX

TROUBLESHOOTING AND FAQ

26.1 The Plugin

Where is the oversampling control? There isn't one - oversampling is always on, sized automatically for your session's sample rate.

Is there a zero-latency or low-latency version? No. There's one R52; your host is told the latency and compensates automatically.

Where is the clean or transparent mode? INPUT is it. The tube sits inside a feedback loop and stays well-behaved at ordinary levels - drive it gently for a transparent sound.

Why aren't the tone controls stepped? The originals weren't either. The readout gives exact recall without steps.

Does it null on a bounce? Yes - same session, same settings, same file.

Is R52 a model of a particular hardware unit? No. It is built from Baxandall's published work; no commercial product was targeted or matched.

26.2 The Controls

I turned SHELF up and lost top end - is it backwards? No, that's correct: clockwise is more shelving, and more shelving is a tamer top.

The same knob position sounds much weaker after I changed CIRCUIT. It is weaker - at the same position, 1952's TREBLE gives roughly three times the lift of either 1957. Read the dB in the help strip, not the angle.

The readout says +700, but the knob only goes to 1. Same position - the knob's printed scale runs −1 to +1, and the readout counts it in thousandths for exact recall: +700 is 0.700 of full travel. Type 700 or 0.7 and you land in the same place.

Engaging LOAD changes the level. LOAD models a downstream amplifier and loudspeaker; loosening the grip costs some level. Turn MATCH on to compensate.

Is 7.0 the speaker's impedance? No - the modeled speaker stays 15 Ω nominal. The dial sets the amplifier's output impedance.

Where is the load control on my real amplifier? Almost certainly not present - it is normally fixed at the design stage.

One tube lamp is brighter than the other. Your material is asymmetric - the lamps show drive per channel, not distortion, and don't compare across the two 1957 voicings.

Where is the second set of knobs for Mid/Side? There isn't one - run two instances instead.

The AMP button is unavailable. AMP requires LOAD to be active. Select any LOAD setting other than OFF. AMP is available on stereo and mono instances; it is unavailable in MID, SIDE, L, and R modes.

The AMP lamp is purple instead of amber. The session is running above 96 kHz. AMP prints during freeze, render, and export, while live monitoring uses the LOAD path. Freeze the track to hear the AMP result in context.

26.3 Presets and Sessions

Where are my presets? In a plain shared folder - rename, nest, and back them up in Finder or Explorer.

I saved a preset in MID mode and it moved another instance into MID. Every preset carries the channel mode it was saved in. A preset with no suffix in its name is in its default mono/stereo mode.

I loaded a SIDE preset on a mono track and nothing was isolated. There is no stereo pair on a mono track, so the plugin defaults to standard operation. If you move this instance to a stereo track, it will switch to SIDE, unless you saved the preset while on the mono track, which clears it.

Deleting a preset - is it gone? No, it moves to the Trash/Recycle Bin.

26.4 Modifier Keys and Shortcuts

- **SHIFT-drag INPUT**: OUTPUT counter-moves by the same amount, so you can change drive while keeping the level steady and hear what the tube contributes without loudness bias.
- **Hold Cmd+Opt (macOS) / Ctrl+Alt (Win/Linux)**: hover over a control to hear the plugin as if that control were at its resting position; the knob does not move and nothing is written to automation or the preset.
- **Click a knob's value readout**: enter an exact value. BASS and TREBLE accept their faceplate range or the thousandths shown by the readout; SOURCE accepts values such as 10k.
- **Click state controls (CIRCUIT, CHANNEL MODE, LOAD)**: move forward through states; right-click to move backward. The contextual help strip identifies the current state.
- **Bottom help strip**: the primary quick reference. It changes with the control and, for state-based controls, follows the selected state. Use it instead of hunting through the manual for a definition.

CHAPTER TWENTY-SEVEN

iPad and iPhone

R52 is on the App Store for iPad and iPhone, iOS 15 or later. It has the same sound, controls and presets. One purchase gives you:

AUv3 plug-in: for Logic Pro for iPad, GarageBand, AUM, Cubasis and other AUv3 hosts.

Standalone app: processes the microphone or an interface. It starts with the input muted against feedback: tap Unmute Input, and use headphones.

27.1 Touch

Adjust: drag up or down. **Reset:** double-tap.

Exact value: tap the readout under a knob and type the value (3.5, 26.4).

Help: with the tooltip switch in the menu on, touch and hold any control; the help strip explains it while your finger rests there.

CIRCUIT, CHANNEL MODE and LOAD: a tap steps forward and wraps around. There is no step back (26.4).

Link Input & Output: this menu entry takes the place of SHIFT-drag on INPUT (26.4). While it is on, turning INPUT moves OUTPUT the other way, and a double-tap returns both to 0 dB.

SCOPE: a tap opens and closes it. On iPad and iPhone the scope is a panel inside R52, not a window: held upright it sits under the faceplate, turned sideways it covers the chassis above it. There is no PIN, because the panel cannot be hidden behind another window (11.4).

MIDI Learn: tap MIDI LEARN, then a knob or a lit control, then send its CC. To remove a mapping, use Manage MIDI Mappings on the MIDI page of the menu.

Two desktop shortcuts have no touch form: the Cmd+Opt (Ctrl+Alt) hold that lets you hear a control at its resting position, and the fine-adjust drag. For a fine move, type the value.

Turn the device sideways for the largest view; held upright, the panel sits in the middle of the screen with the scope under it. The panel always fits the screen or the plug-in

window, so there is no window size to set. The App Store purchase is your license: there is nothing to activate, and the menu has no License Status. Manuals opens the Quick Guide and these guides on the web. Inside a host the plug-in cannot open a browser, so there it copies the link instead: paste it into your browser.

AMP is R52's heaviest option (7.9, 25.2), and phones and tablets have less processing to spare than a computer. On an older device one instance with AMP can use most of it. If the sound breaks up, turn AMP off and let LOAD alone color the sound, or raise the buffer size in your host.

27.2 Presets on iPad and iPhone

Your presets live inside the app, shared by the plug-in and the app; there is no preset folder to open (23.1). The factory presets are installed the first time R52 starts, and updates never touch your presets: a factory preset you deleted stays deleted, and new ones arrive once.

In the browser, a tap loads a preset and shows its description, and a double-tap loads it and closes the browser. Touch and hold a preset or a folder to open its menu, the one a right-click opens on a computer: Rename, Move to folder, Delete and the rest. Dragging in the lists only scrolls them; to move a preset or a folder, use Move to folder.

EXPORT shares the selected preset through the share sheet; IMPORT brings one in from Files. That is also how presets travel between your devices and your computers (23.8). DELETE removes a preset or a folder for good, after asking: iPad and iPhone have no Trash (23.7). Deleting the app deletes your presets: export them first.

CHAPTER TWENTY-EIGHT

Linux

R52 for Linux is the same plug-in as on macOS and Windows, as VST3 and LV2. It runs on 64-bit x86 Linux with glibc 2.34 or newer: Ubuntu 22.04, Debian 12, Fedora 35 and Linux Mint 21 or later, and current Arch-based distributions. It was tested in Ardour 9, Mixbus 11.3 and REAPER 7.

28.1 Installing and Activating

The download holds two packages that install the same plug-in. Use one of them, never both:

.deb package (Ubuntu, Debian, Mint, Pop!_OS): in its folder, run 'sudo apt install ./r52-baxandall_<version>_amd64.deb'. It installs the LV2 for the whole computer, links the VST3 into every account's '~/.vst3', and gives each account the factory presets and this guide. An account created after the installation can use the LV2 at once; 'sudo dpkg-reconfigure r52-baxandall' gives it the VST3 link as well.

.tar.gz archive (any distribution, no administrator rights): unpack it and run './install.sh' in its folder. It installs into your own '~/.vst3', '~/.lv2' and '~/.local/share'.

Two copies of the LV2 make Ardour and Mixbus crash, so 'install.sh' refuses to run while the .deb is installed, and the .deb warns about an archive copy it finds. After installing, rescan plug-ins in REAPER or Bitwig Studio; Ardour and Mixbus scan at start-up, so restart them. To update, install the new version the same way; your presets and settings stay. Uninstalling is described in 24.7.

Until R52 is activated it replaces the audio with noise; that is deliberate, not a fault. Open the menu at the top right, choose License Status, enter your key and click Activate. One activation covers every host and both formats for your account on this computer.

The license is tied to this installation of Linux, so reinstalling the system or cloning it counts as a new computer. If R52 reports that it is unlicensed on a computer where it was activated, please contact us instead of activating again: activations are limited.

28.2 Files, Hosts and Mono Tracks

What	Where
Presets	~/.local/share/Pulsar Modular/R52 Baxandall/Presets
User guides	~/.local/share/Pulsar Modular/R52 Baxandall/User Guides
Settings	~/.config/Pulsar Modular/R52 Baxandall
MIDI mappings	~/.config/Pulsar Modular MIDI/R52 Baxandall
License	~/.config/Pulsar Modular/Licensing

On Linux the preset bank belongs to your account; other accounts on the computer have their own. A preset you delete in the browser goes to the desktop's trash, so you can restore it from your file manager. Uninstalling leaves all of these folders where they are (24.7).

REAPER: use the VST3. REAPER cannot automate the LV2 parameters of JUCE plug-ins such as R52.

Ardour and Mixbus: both formats work. In both, the host's bypass switches R52's own bypass (9.1); in the LV2 the IN/OUT lamp does not follow it, because the LV2 has no bypass parameter for the lamp to mirror.

Bitwig Studio: use the VST3; Bitwig has no LV2 host.

Mono tracks: with strict I/O (every Mixbus track, and Ardour's default for new tracks) the VST3 runs as a true mono plug-in and CHANNEL MODE reads MONO. The LV2, and the VST3 on a track without strict I/O, get the track on the first input and silence on the second, so leave CHANNEL MODE on STEREO there.

28.3 Window, Display and Performance

In Ardour and Mixbus the VST3 window resizes from the lower-right corner of R52's panel, because those hosts cannot shrink a resizable VST3 window from its frame; the LV2 window resizes from its frame. If the window's shape differs from the panel's, the panel is letterboxed, never stretched or cut off.

The panel can be made as small as 50 % of its design size, so it fits REAPER's bottom docker at any interface scale. On a HiDPI screen both formats follow the DAW's own

interface scale, and the window never opens larger than the screen. In REAPER, a window you undock keeps the docker's width until you resize it once.

Loading and saving MIDI mappings opens the desktop's own file dialog (zenity, or kdialog on KDE) in the mappings folder.

AMP is R52's heaviest option (7.9, 25.2). With AMP on, R52 processes the two channels of a stereo track side by side on two CPU cores whenever the DAW's audio thread has realtime priority (R52 asks the system's RealtimeKit service for the same priority), and one after the other otherwise. Both sound the same.

Crackles under load usually mean that the DAW is missing realtime privileges. Add your account to the audio group and give the group realtime limits, then log out and back in:

```
sudo usermod -aG audio $USER

printf '@audio - rtprio 95\n@audio - memlock unlimited\n' | sudo tee /etc/security/limits.d/99-audio-rt.conf
```

On a laptop, also switch to the performance power profile ('powerprofilesctl set performance') for low-latency sessions.

Appendix A. Primary Sources

Everything historical in this guide comes from documents published openly and still readable today:

P. J. Baxandall, "High-Quality Amplifier Design," *Wireless World*, January 1948.

P. J. Baxandall, "Negative-Feedback Tone Control," *Wireless World*, October 1952. The article the instrument revives (Chapter 19).

The erratum to that article, *Wireless World*, November 1952. Publishes the alternative shelving condition reproduced at the far end of SHELF's travel in the 1952 circuit (Chapter 4).

P. J. Baxandall, "Inexpensive Pre-Amplifier," *Wireless World*, May 1957, p. 209. Contains his second voicing of the network (Chapter 20).

M. V. Thomas, "Baxandall tone control revisited," *Wireless World*, September 1974. The trade press's own record of how the name detached from the original papers (Chapter 21).

BBC Research Department Report 1976/29, on the LS3/5A loudspeaker. Source of LOAD's 7.0 Ω setting (Chapter 22).

All six circulate freely and have for decades.

Appendix B. Credits and Independence

The Name

The product is **R52 BAXANDALL**, subtitled **NEGATIVE FEEDBACK TONE CONTROL** - the title of Baxandall's October 1952 article. "Baxandall" is used throughout this guide as the standard term for the circuit topology, the way the audio trade has used it since at least 1974.

Independence

R52 is not affiliated with, and is not endorsed by, any commercial Baxandall-derived product. No commercial equipment was targeted or measured in its development; R52 was built from Peter Baxandall's published articles.

R52 is likewise not affiliated with, and is not endorsed by, Peter Baxandall's estate. The history chapters, Chapters 19 through 22, are about his published work. Nothing in this guide or in the product implies his involvement in R52, or any endorsement of it by him or by his estate.

Credits

R52 Baxandall is a product of **Pulsar Modular**.

Design & Research: Ziad Sidawi

Plugin Development: Mesut Saygıoğlu

GUI Development: Max Ponomaryov / azzimov GUI design – www.behance.net/azzimov

User Guide: Ziad Sidawi

Page Layout: Burak Öztop

Please kindly report any errors or omissions in this user guide to psupport@pulsarmodular.com.

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