Nº53

REFERENCE POWER AMPLIFIER

mark levinson®

Reinventing the Power Amplifier – Again

The Mark Levinson® ML-2 power amplifier, introduced in 1972, flew directly in the face of conventional wisdom, demonstrating beyond all doubt that a solid-state amplifier could outperform its vacuum-tube counterparts. A 25-watt pure Class A monaural power amplifier, the ML-2 set Mark Levinson engineers on a path – designing and building the world's best-performing linear power amplifiers – they've been traveling ever since. But technology continues to advance, often relentlessly, and Mark Levinson products advance with it.

The №53 Reference monaural power amplifier is a landmark, the first-ever switching power amplifier from the Mark Levinson brand, and the first Mark Levinson power amplifier to earn the Reference designation since the №33 in 1994.

Switching power amplifiers are not new, and although they offer several advantages over linear designs – more power, increased efficiency, compact dimensions, lower weight and less heat dissipation – they've been generally maligned by audiophiles for inferior sound quality. The audiophiles are right – there are significant technical limitations inherent in conventional switching designs. But Mark Levinson engineers have successfully overcome the limitations with the №53.

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Born of Listening

New Mark Levinson products are not introduced with the seasons, or according to arbitrary marketing schedules. They're introduced as new technologies, which have shown promise on paper, are perfected and proven through rigorous in-house development and evaluation procedures. In the case of the Nº53, a highly experienced evaluation team was assembled to conduct blind and sighted listening tests of a novel switching amplifier prototype, measuring it against past and present Mark Levinson linear power amplifiers as well as a range of competitive products.

As the development process wore on, power amplifiers deemed sonically inferior were removed from further testing. Several judges were surprised to learn that the new switching amplifier was never among them. In fact, the early Nº53 prototype emerged as a winner, with several panelists awarding it top honors for speed, dynamics and clarity. It was, to say the least, an unexpected result. For a mere prototype switching amplifier to hold its own against linear amplifiers that were deemed to be the very best the marketplace had to offer – time-honored Mark Levinson models included – meant we knew we were dealing with a paradigm-shifting design.

Convinced that the minor quibbles that had come up during the initial listening tests could be overcome, the Nº53 project was commissioned, and development of the first new Mark Levinson Reference power amplifier in more than a decade began in earnest.

The Technical Challenges

All power amplifier designs have inherent pros and cons based on their design topology, and switching designs are no exception. On the plus side, switching amplifiers are more powerful, smaller and run cooler than their linear counterparts – by several orders of magnitude. As points of comparison, the Mark Levinson Nº33 is rated at 300 watts into 8 ohms, measures 31 x 14 x 31 inches and weighs in at 435 pounds, while the Nº53 – at 500 watts, 21 x 9 x 21 inches and 135 pounds – is nearly twice as powerful, substantially more compact and 300 pounds lighter.

The Nº53 is capable of generating truly phenomenal power levels to support both the instantaneous and continuous demands of virtually any speaker load. More impressive, the Nº53 accomplishes this feat while maintaining a constant, thermally balanced operating temperature. Although always warm to the touch, the operating temperature of the Nº53 will not vary – or exhibit even the slightest change in performance capability – regardless of how long or hard the amplifier is driven.

The downside of switching power amplifiers? Because they switch output devices on and off in very rapid succession to mimic the input signal – one set of output devices drives the positive half of the waveform, and a separate set drives the negative half – switching noise and dead bands become significant design challenges.

Switching Off Switching Noise

In most switching power amplifier designs, a brick-wall filter is placed above the audio band to remove switching noise. But because of the filter's physical proximity to the audio band, this has a significant adverse effect on phase relationships, the smoothness of frequency response and imaging. In short, it degrades overall sound quality. To overcome this challenge, Mark Levinson engineers devised Interleaved Power Technology (IPT), a patented method of raising the amplifier's switching frequency. In the case of the Nº53, the switching frequency is raised to an extremely high

2MHz, delivering two major sonic advantages. First, it pushes the fundamental switching noise and associated harmonics so far above the limit of human hearing that they have no direct effect on sound quality. (In fact, most audio testing devices can't even measure such frequencies.) Second, it allows for easier removal of switching noise from the signal with much gentler notch filters, which have no negative effect on the crucial audio band. The result is frequency response that is ruler-flat across the entire audio spectrum, dipping only a few dB at 100kHz. That's impressive performance for any power amplifier. For a switching power amplifier, it's nothing short of remarkable.

Eliminating Dead Bands

The other technical challenge for switching power amplifiers are dead bands – silent gaps in audio output created when the output devices driving the positive half of the signal and outputs driving the negative half are both turned off. This occurs every time the audio waveform crosses from positive amplitude to negative amplitude, or back again (about forty thousand times per second for a 20kHz audio signal). Because even the best output devices cannot switch on and off instantaneously, a signal gap is created between each half of every waveform. Large gaps are highly detrimental to the audio signal, but even the tiniest gaps have a negative impact on sound quality – listeners will perceive that something isn't right.

Dead bands can be minimized by keeping both sets of outputs off for as short a time as technically possible. But doing that increases the possibility that opposing output devices may come on at the same time – doubling the voltage they draw – which could easily damage or destroy them. Engineers are forced to arrive at a middle ground between sound quality and reliability when designing switching power amplifiers.
Mark Levinson engineers saw this as unacceptable and instead developed a patented technology for the №53 that permits both sets of output devices to be on simultaneously for short periods of time. Dead bands are completely eliminated, without in any way compromising the life expectancy of the output devices.

Optimizing the Layout

The primary function of any Mark Levinson Reference product is to reproduce sound at the purest level possible. With power amplifiers, the challenge is to amplify the incoming audio signal without distorting it and to effortlessly drive a wide range of loudspeaker impedances at any volume level with the forcefulness and grace that Reference-quality sound reproduction demands.

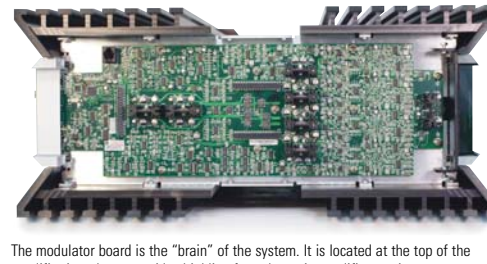
Toward that end, the №53 chassis is a compact vertical design with four separate internal compartments to shield and isolate different kinds of circuitry. The power supply – an extremely low-noise toroidal transformer with an oversized 2.8kVA transformer and four 47,000µF low-ESR capacitors – is placed in the bottom compartment to reduce interference from magnetic fields and high-current devices. The two middle sections contain four amplifier modules, which are arranged symmetrically and mirror-imaged to maximize separation. The top compartment includes the control circuitry, which has an independent regulated power supply that's shielded from the rest of the amplifier to prevent audio-circuit interference.

Eight large coils – two per amplifier module – essentially create four separate power amplifiers, which are responsible for the exceptionally high power levels, large dynamic and stunning clarity of the №53. Working together, these amplifiers raise the effective switching frequency from 500kHz to 2MHz, producing the best sound quality ever achieved in a switching amplifier.

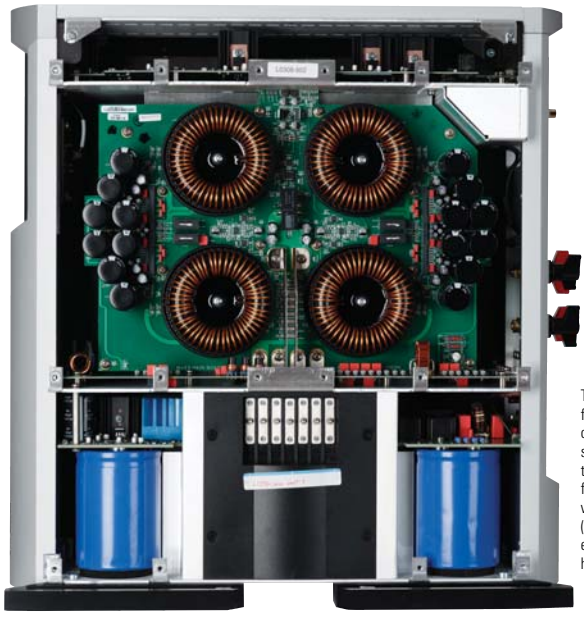
Special attention was paid to the signals that pass between different boards. Extensive use of low-voltage-differential signaling (LVDS) for control signals maximizes their integrity, while all analog signals remain balanced for superb noise rejection.

It's Your Turn to Listen

With the technical hurdles of switching power amplifiers behind us and with the internal layout finalized, the №53 development team headed back to the listening room. We listened with different types of music. We listened with different speakers, electronics and cables. We listened in different rooms. We compared the №53 to other Mark Levinson power amplifiers. We compared it to the power amplifiers of our competitors. We listened blind, we listened sighted and we flew in customers from around the world to listen with us. Only then, when we were convinced that we had coaxed the last ounce of performance from this revolutionary design, did the №53 go into production. Now we invite you to listen to the world's new Reference standard, and experience the incredible depth and detail it uncovers in any source material.



The modulator board is the "brain" of the system. It is located at the top of the amplifier in order to provide shielding from the main amplifier section.



This side view shows the four different compartments of the amplifier: the power supply section at the bottom, the middle section with the four amplifiers, the top section with the control circuitry (modulator), and a separate enclosed box (top left) that houses the analog input board.

N°53 Reference Power Amplifier

Input and output connectors	One balanced XLR input One unbalanced RCA input Two pairs of "Hurricane" loudspeaker output binding posts with banana-plug sockets (banana-plug socket not available for some models)
Control connectors	Two Link2 ports (one input and one output) One Ethernet port One 3.5mm mono (tip/sleeve) mini plug trigger input, 3-12Vdc One 3.5mm mono (tip/sleeve) mini plug trigger output, 3-12Vdc 3-Pin IEC standard power connector
Rated output power	500W @ 8Ω, 1000W @ 4Ω Power ratings are measured as RMS power from 20Hz to 20kHz with no more than 0.1% THD
Frequency response	Within ±0.1dB from 10Hz to 20kHz
Signal-to-noise ratio	–85dB, reference level: 2.83 Vrms (1W @ 8Ω)
Input impedance	100 kΩ (balanced); 50 kΩ (unbalanced)
Voltage gain	26.8dB
Input sensitivity	2.89V for maximum rated output power
Power requirements	100V~, 120V~, 230V~, 640W, factory-set for destination country
Dimensions	Height: 20-3/8" (530mm) Width: 8-7/16" (214mm) Depth: 20-3/8" (518mm)
Weight	Net weight: 135 lb (61.3kg) Shipping weight: 165 lb (75kg)
Operating environment	Operating temperature: 0° to 35°C (32° to 95°F) Storage temperature: –30° to 75°C (–22° to 167°F) Relative humidity: 95% maximum without condensation

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