
LAMM INDUSTRIES, INC.

The Best Single-Ended Amplifier There Is? LAMM ML2

ULTIMATE AUDIO, issue 3, number 1 (Spring 1999)
by Lars Fredell

At the outset, let me tell you that this review is a tribute to a man, his perseverance, his talents--and his product! It is often said that the best performances or inventions come out of situations of hardship. This is particularly true in the case of LAMM electronics. The creator of these outstanding components, Vladimir Shushurin, can literally credit his abilities as an audio engineer for his survival in a crumbling Soviet Union. Simply put, Shushurin was too valuable to dispose of during the general persecution of the Jewish population in Russia. As an elite table tennis player as well as a percussionist in a symphony orchestra, he had some natural survival talents.

It was Shushurin's abilities as an audio engineer however, that permitted him to exist in relative freedom. Schooled at the Lvov Polytechnic University, a source of high-level recruits for the armed services, Shushurin eventually ended up as the chief-designer at a large consumer electronics factory. This gave him the long sought opportunity to, as he says, "study the human hearing mechanism." These studies resulted in a set of mathematical calculations, which Shushurin feels correctly describes the inherent distortion factors of the human ear. Thus, when the ear is confronted with a musical signal that incorporates these distortions, the brain overlooks them and we perceive the musical signal as being very natural sounding. He theorizes that the ear's distortion factors have a relationship to both sound pressure levels and frequencies, among many other variables, and he labels these calculations as "Absolute Linearity of a System" (ALS).

Since his arrival in the US in the late 1980's, Shushurin finalized the design, and started production, of an award winning line of hybrid/solid-state amplifiers (M1.1 and M2.1), a line of vacuum tube amplifiers (ML1 and ML2) and the L1 line stage. I've been the lucky owner of the M1.1 since 1993 and have, up to this point, considered it the finest piece of electronics I have ever heard.

However, it is in the design of vacuum tube electronics that Shushurin's enormous design talents are truly revealed. As a technician and engineer in Russia, Shushurin was literally born with a tube in his mouth and spent the better part of his life trying to optimize the yield of the glass devices.

Over the past year, I have had the opportunity to become intimately familiar with the sound of both the ML1 push-pull triode design and the ML2 single-ended triode-so it's been a good audio year for me! This review covers some of my impressions of the ML2.

The ML2 design is centered around the large Russian 6C33C-B dual-triode vacuum tube. This is a high power/low internal impedance tube, making it possible to design output transformers with very low turns ratio. Such transformers permit very extended frequency decade factors at both extremes as well as a dramatic reduction in leakage inductance. Net result: natural sound reproduction not only in the midrange (where triodes rule) but also in the low and high frequencies (a traditional weakness of triode designs). The drawback is that these particular transformers are difficult to design and very costly.

The 6C33C attracted Shushurin's attention back in 1973 when he started experimenting with it for audio applications. He designed and built his first OTL amplifier based on this tube in 1976; subsequent research led to a variety of single-ended and push-pull amplifiers utilizing output transformers which Shushurin also designed. In the ML2 design, the 6C33Cs are used both in the output stage and as a voltage regulator supplying current to the output stage tube.

That use of vacuum triodes in the output stage results in high quality sound is well accepted, although personally I have always stayed away from such designs, especially single-ended ones, because neither their power resources, nor their reproduction of the frequency extremes were satisfactory. So, I've had a deep-rooted bias against them; they're too rolled-off for me. My friend Sam Tellig, long-time single-ended aficionado, has often berated my stance maintaining that "all the action is in the midrange" and that's the strength of these design. He is right, of course, but I have obstinately stuck to my contention that some of the critical action that I also need is at the frequency extremes. So, he's favored single-ended amplifiers and I've stayed with push-pull solid-state and hybrid designs.

Actually, my experience with tube designs dates back almost 40 years ago when growing up in Stockholm, Sweden and building a Dynaco amplifier. It was a failed effort; I had to send the amplifier to an expert in order to locate some cold solders and other errors. Later on, in the mid-1960's, I became somewhat of a Disco pioneer while at business school, made some money that I promptly spent on cars and fancy McIntosh equipment which was followed by some early solid-state designs. Much later yet, after settling in the US, I bought the original Quicksilver monoblocks which were substituted by a string of Krells. About a dozen years ago, my most recent tube experience included Jadis JA-30s and JA-80s. And now the circle is completed with the fabulous LAMM ML2. ST is gloating, big time: "The bullheaded Swede has finally seen the light. Hah!" True, indeed, but it certainly took an exceptional design to make me toe ST's line.

The strengths of the ML2 are not obvious from the external design. While campy-retro, the look of these amplifiers is decidedly modest, especially in view of the almost \$30,000 per pair price tag. When asked about this, Shushurin scoffs: "If you're looking for chromed bumpers, look elsewhere. The beauty lies within!" While I might not love the external design, it is highly functional and it sure looks serious.

Single-ended designs are inherently inefficient and so are triode vacuum tubes. This makes it very difficult and complicated to build relatively powerful amplifiers of this type. It is also extremely costly (good, handbuilt transformers like the ones in the ML2s are very expensive). Therefore, as far as single-ended triodes are concerned, the 18 to 20 watts output power of the ML2 is quite a significant achievement. My Verity Audio Parsifal Encore's 89 dB efficiency rating does not make them the ideal power partner for the ML2, I'm sure. But, the speed, neutrality, delicacy and coherence of this speaker, on the other hand, is just about ideal. And, as ST likes to point out, the resolution and linearity of good single-ended triodes are so fine that one tends to listen at lower volume levels than with other types of amplifiers. I have found this to be particularly true with the ML2s.

Perhaps the more apparent difference between the ML2 and other single-ended designs is its ability to reproduce full, extended and very powerful bass. I mean POWERFUL! And, I'm not sure that I've experienced the true measure of this amplifier yet. A speaker with 96 to 100 dB efficiency might drive this point home better. However, my listening sessions with the Parsifal indicates that the amplifiers are capable of producing outstanding bass also with relatively less efficient speaker loads. An almost unique virtue for the ML2 as far as I know.

It's not just that the bass has power and punch even in the deepest regions; it's the quality that comes through in the harmonic content that surprises. The bass is so vibrant and complete in its richness that it's difficult to believe that one is listening to a single-ended triode. The inherent weaknesses in quality bass response in this type of amplifier is so completely removed in the ML2 that one is tempted to question whether it is possible to improve on it at all. Quite simply, this is the most complete bass reproduction I've ever heard.

I could easily go on and make the same kind of claims for the top end of the ML2. Again, one is amazed at the ease and utter beauty of the higher frequencies. Female sibilance, especially sopranos, and massed first violins are notoriously difficult to reproduce correctly. Part of the problem here is that there are precious few recordings available where this is captured completely, or properly. The ML2 doesn't seem to flinch and you'll quickly find out which of your recordings are good, and also, unfortunately, how many bad ones you have.

The greatest thrill for me with the whole concept of single-ended triodes lies, as I'm sure it does with you, in the way that the instruments in the midrange are reproduced. This has become the hallmark of this type of components. And, when ST has pestered me about this in the past, I have grudgingly concurred with him in the name of honesty. (This has not prevented me from refusing to admit to hearing the beauty that he many times professed to hear in certain similar equipment. But I did that mostly as a revenge for some of the things he'd said about me in print elsewhere--and to see the intensification of his facial color).

I don't know what the foundation is for the unbelievable midrange of the ML2. I think that it boils down to the fact that Shushurin has gotten the transients of the minutest micro-dynamics right. This is the kind of stuff that makes you sit up straight and nod in recognition as very small sound impulses come through in the right way. Things like clatter from instruments, vibrations from strings or a singer opening his/her mouth or swallowing--or even the "sound" of the air at different recording venues. As ST says, this is where the action is. And, it sure is with the ML2s!

I could easily write a review twice the length of this one extolling the many virtues of the LAMM ML2. Let me end this by saying that in my 40-year experience as a music lover, and an aficionado of this industry, I have never come across as fine and fulfilling a product as this one. Can't you find something to criticize, you wonder? Well, dear reader, I started out with a very negative bias so I sure tried hard. For instance, when I pointed out to Shushurin that the binding posts seemed a little cheesy for such an expensive product, he just gazed calmly at me and said "cheesy look maybe, but this post turned out to be more sonically neutral for this particular design than anything else available." So there you have it. Everything in the LAMM ML2 amplifiers is optimized for the best possible sound!

My answer to the question in the headline is an emphatic YES! The LAMM ML2 is, indeed, the best there is.

Technical Highlights

The LAMM ML2's signal path is based entirely on vacuum tube triodes and utilizes the 6C33C-B in both the output stage and as the voltage regulator. The amplifiers have a nominal power ratings of 18 watts (max. 20 watts) into 4, 8 or 16 Ohms from 20 Hz to 20 kHz. The front end consists of two stages. The first is based on a 12AX7 tube, both triodes of which are connected in parallel. The second stage incorporates the unique Russian 6N6Pi tube which, according to Shushurin, possesses the qualities of an ideal driver such as: high linearity even at highest levels of output signals (both sinewave and pulse); extremely low (for this type of tube) internal impedance and significant plate dissipation; and a very extended life span (approx. reliability level >0.99!). All of this permitted LAMM to create a very linear voltage amplifier with a maximum swing of over twice the value needed to drive the output tube. While all the early theoretical calculations of electrical parameters were done in Russia, it still took LAMM 18 months to finalize the design of the output transformers in the US. These transformers have literally no limitations on linear reproduction of the signal in the frequency range starting at 16 to 20 Hz and up to almost ultra-high frequencies at all power levels, including the maximum. The same applies to the output stage. To ensure the constancy of the Q-point of the output tube and to get the maximum power output from this particular tube type without overheating, a voltage regulator utilizing 6C33C-B, 6AK5/5654 and 5651 tubes regulates the plate voltage of the output stage. Note here, that while this is a very attractive solution it is also very costly in implementation, especially in view of the fact that the idly current of the output stage is a relatively high value at more than 0.3 Amps. The LAMM ML2 is partially

manually assembled using point-to-point wiring. To ensure quality and reliability, some of the finest materials and world class parts (including highly reliable vacuum tubes, specially selected and tested) are used. All components are carefully tested in-house. Two multi-turn trimming pots accessible through special openings in the amplifier's chassis, along with two test points, allow the user to adjust and measure the nominal value of plate voltage and plate current of the output tube. Once set and stabilized, they require a minimum of attention. In my case, the amplifiers proved to be incredibly stable with variations from the ideal only occurring as the AC voltage varied. The protection circuitry is of a "soft-start" type. Not only is this circuitry combined with both the protection circuitry and a delay in activation of plate current, it also tests the amplifier after its turn-on and smoothly supplies plate voltage to the output tube. This process takes about two minutes, a time necessary to warm the heaters of the output tubes. The steadying of a blinking LED on the front panel indicates that the process is completed and that the amplifier is ready for use. There is also a thermal fuse inside the power transformer eliminating any possibility that overheating could destroy the amplifier. The ML2, like all LAMM products, undergoes a 72-hour burn-in test after the preliminary testing. After that, the amplifiers go through a second round of testing and complete check of all parameters. Only after this testing is completed are the amplifiers shipped. Optimum performance level is reached after approximately 90 to 100 hours of operation. In my experience, the amplifiers need about 45 minutes of warm-up to sound their best. All of these features, in conjunction with a meticulously selected topology, has permitted the design (perhaps for the first time in the world of audio) of an almost perfectly linear single-ended triode amplifier capable of reproducing an entire range of audio frequencies at all power levels, including maximum specified power. Not an easy thing to do--an amazing achievement. A very complete set of measurement graphs from an independent test laboratory is available from LAMM and also on their website.

[LAMM ML2 monoblock single-ended amplifier](#)

[LAMM Industries, Inc.](#)

[2621 East 24th Street, Brooklyn, New York 11235.](#)

[Tel: \(718\) 368-0181. Fax: \(718\) 368-0140.](#)

[Website: \[www.lammindustries.com\]\(http://www.lammindustries.com\).](#)

Designer: Vladimir Shushurin.

Rated power: 18 watts (4, 8, or 16 Ohms).

Frequency response: 16 Hz to 100 kHz@18 W (-3 dB).

Input sensitivity: 0.775 V RMS for full power.

Damping factor: typically 9.5 re: 16 Ohms
(from 20 Hz to 20 kHz).

Slew rate: 15 Volts/uS.

Weight: 68 lbs.

Dimensions: 16" x 20" x 8" (w x d x h).

Warranty: 5 years.