

## David Berning

(1951–)

By Robert Harley

**THE GREATEST GENIUSES** in any field seem to show their inventiveness at an early age, foreshadowing the achievements to come. That's certainly true of amplifier designer David Berning. As a boy in the 1960s, he was fascinated by the family's Voice of Music open-reel tape machine and enthralled by the sound produced by a 1948 tube amplifier driving a large bass-reflex speaker. By the time he reached his teens, David had worn out the tape machine listening to his own music and had been routinely replacing parts to keep it functioning. After switching the heads, David decided to build his own tape machine from scratch using the worn heads from his father's deck. David's tape machine was a concoction of a washing machine accessory motor, Erector Set wheels, a carved-wood slip-clutch covered with felt, and a borrowed guitar-amplifier circuit. By the end of high school, David had built four versions of this kludged tape deck.

During his college years, David turned to amplifier design. His major was physics (he graduated with a BS degree), but he took some elective courses in electronics.

He was building amplifiers for his own use that combined tubes and transistors. He had no inkling that there was a community of audiophiles who valued sound quality or that there was a renewed interest in tube amplifiers after the ascension of the transistor in the 1960s. He met an audiophile who appreciated David's tube designs and introduced the amplifier to some friends. Some of the people who heard the amplifier asked to buy it, and thus the David Berning brand of amplifier was born.

Designing and building audiophile tube amplifiers didn't seem like a promising career path, so David took a job at the National Bureau of Standards/

National Institute of Standards and Technology designing test instrumentation that wasn't available commercially. Much of his work was developing instrumentation that characterized semiconductor performance to discover standard measurements that could be applied throughout the semiconductor industry. Ironically, David designed many of these instruments in part with vacuum tubes to obtain a combination of speed, voltage, and power that could not be achieved at the time with existing solid-state devices. As a side benefit to his work in this area, he developed a very good understanding not only of the limits under which transistors could reliably operate but also of the limits for vacuum tubes as well. Even more important was an understanding of what phenomena really affected these limits. This understanding played a large role in improving David's circuit

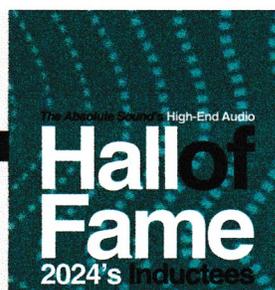
design for new instruments but naturally extended to audio amplifier and power supply design. David had two parallel careers: the research position at the National Bureau of Standards and making audio amplifiers for sale in his spare time.

In 1976, Berning was issued a patent for his tube screen-drive using bipolar transistors. While David made a significant number of what was designated the Berning EA2-150B, he licensed the patent to Audionics of Oregon, and they produced the BA-150 for several years. These amplifiers incorporated digital auto-bias.

In the late 1970s, Berning wanted to make a one-box version of his two-chassis P1 preamp and saw the solution as a switch-mode power supply. At the time, no high-end manufacturer used a switch-mode supply. Indeed, they were anathema. But the new preamp with its switch-mode supply, the TF-10, was a critical and commercial success.

Harry Pearson reviewed the TF-10 in these pages and praised its sound but commented that it would sound even better with a larger power supply, not understanding that switch-mode supplies, which had never been used in a high-end product previously, are smaller and lighter than linear supplies. The TF-10's gain stages, which combined p-channel FETs with tubes, was the subject of a patent. Two other landmark amplifiers using switch-mode sup-

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plies were the EA-2100 and EA-2101. These employed the first generation of MOSFETs in the output stage along with a 6LF6-based input stage. Both amplifiers had an innovative “parallel resonance technology” switch-mode supply that used frequency modulation rather than the standard pulse-width modulation, allowing higher levels of energy storage and improved bass impact. All Berning amplifiers since the EA-2100 have used this parallel resonance supply. Berning’s pioneering embrace of switch-mode power supplies more than 40 years ago, along with his innovation in their design, exemplifies his creativity and penchant for seeking unconventional solutions.

David was ready to get out of the audio business, but he started experimenting with adapting this parallel resonance power supply to an amplifier output stage. He discovered an interesting phenomenon in the circuit that made him think that a version of the circuit could emulate the output transformer in a tube amplifier. He decided to try to build an output transformer-less tube amplifier, adapting one of his 50W units. An output transformer-less tube amplifier had been a kind of holy grail for amplifier designers, but all previous attempts at creating one suffered serious shortcomings. (An interesting and highly entertaining chronicle of this quest can be found in the late Harvey Rosenberg’s book *Understanding Tube Electronics: A Study in Natural Harmonics Audio*.)

David traditionally supplied the audio system for the National Bureau of Standards’ Christmas gathering and decided to bring this radically different amplifier to the party. He imagined that his colleagues would be intrigued by such a small, lightweight, transformer-less tube amplifier, and if it didn’t sound good, people probably wouldn’t notice. He thought this experimental amplifier would be more of a curiosity than a sonic breakthrough. But when he first listened to the amplifier, he was astonished by what he heard. The sound had a realism and immediacy that sounded like no other amplifier in existence. Removing a tube amplifier’s output transformer and replacing it with David’s newly developed circuit turned out to be a startling advance. Rather than quit the audio business, David decided instead to file a patent on this new circuit.

That patent, issued in 1997, became the foundation for all Berning amplifiers to come—the ZOTL circuit. The late Harvey Rosenberg came up with the ZOTL name, combining OTL (output transformer-less) with Zero hysteresis, because the circuit eliminated the hysteresis present in audio output transformers. The new technology greatly extended the potential frequency response of tube amps and could now pass dc, thus allowing good auto-bias to be included. The first production ZOTL product was the highly successful ZH270, a compact integrated dual 70-watt amplifier introduced in 1996. Despite its complexity, it has a reliability track record that far exceeds that of any prior Berning transformer-coupled amplifier. The technology is now licensed to Linear Tube Audio, which produces several products based on the ZOTL circuit.

Our resident tube maven Dick Olsher said this about the ZOTL circuit in his 2011 review [Issue 210] of the Berning ZH230: “In my book, a new product introduction from the creative mind of David Berning is an event. His designs are far from being yet another twist on a 1950s circuit, which to be perfectly honest is what most of tube audio is about nowadays. Although the ZOTL technology has been around for over a decade and could be considered mature, it still looks and sounds cutting-edge. The Berning ZH-230 is the one, the anointed new king. It represents in my estimation the state of the art in medium-power amplification.”

About 10 years ago, Berning teamed up with Rick Brown of HiFi One to produce more ambitious implementations of the ZOTL circuit. Brown was a

fan of David’s amplifiers and envisioned realizing the circuit with a much higher level of execution to unleash their

full sonic potential. Their first collaboration was the Berning/HiFi One 211/845, a 60W push-pull amplifier. In my review of that amplifier in 2016, I wrote: “All the specific sonic attributes described in this review are simply corollary to every audio component’s fundamental goal of conveying the musicians’ expression and to engage the listener in that expression. When judged by that criterion, I can say that the 211/845 is the finest amplifier I’ve ever heard.”

And then just this year, Berning and Brown topped the 211/845 with the Berning/HiFi One Reference SET, a cost-no-object realization of Berning’s circuit. This 20W single-ended triode amplifier, with its massive outboard silver-wound chokes, redefined power amplifier performance in my view. When mated with an appropriate loudspeaker, the Reference SET simply has no peer in timbral liquidity, immediacy, soundstaging, and an absolutely uncanny ability to sound like music rather than an electro-mechanical reproduction. Praise doesn’t get much higher than that.

For David Berning’s nearly 50 years of truly original technical innovations in the service of music, we are delighted to welcome him into *The Absolute Sound’s* High-End Audio Hall of Fame.

