

Powersoft M-System

From Switched-Mode Amps to a Novel Transducer



Powersoft's M-System combines the M-Force motor transducer and the M-Drive switching-mode amp module, taking advantage of Differential Pressure Control (DPC) technology among several other company innovations. The project is the result of the company's continued search for new technologies and ideas from innovative concepts. In this article, we follow the effort—from a Eureka moment to a well-devised solution, which is now available to the OEM market.

By
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After 20 years convincing the market that Class-D could replace existing linear amplifiers designs, Powersoft has reached a milestone in loudspeaker engineering. But just how did an amplifier company decide to develop a transducer?

Founded in 1995 and headquartered in Florence, Italy, Powersoft designs and manufactures technologies and solutions for the professional audio industry. Mainly recognized for its lightweight, high power, energy efficient, switched-mode technology Class-D amplifiers, Powersoft is also recognized as a "rich" company in terms of developments, and not just in the field of pure amplification technologies.

As Matteo Bianchini, Powersoft's OEM Account Manager states, "We're well aware that amplification is just a link in the audio chain, and any technical progress cannot bring a real major benefit if it doesn't involve, in some way, other elements of such a complex system."

That statement, might help us understand how Powersoft got involved in such innovative projects as the DEVA multifunctional device, which is basically a speaker equipped with several sensors (i.e., a microphone, a presence detector, a twilight switch, and an accelerometer), a video camera, LED lights, and everything needed to combine public address with audio messaging and video capturing. This

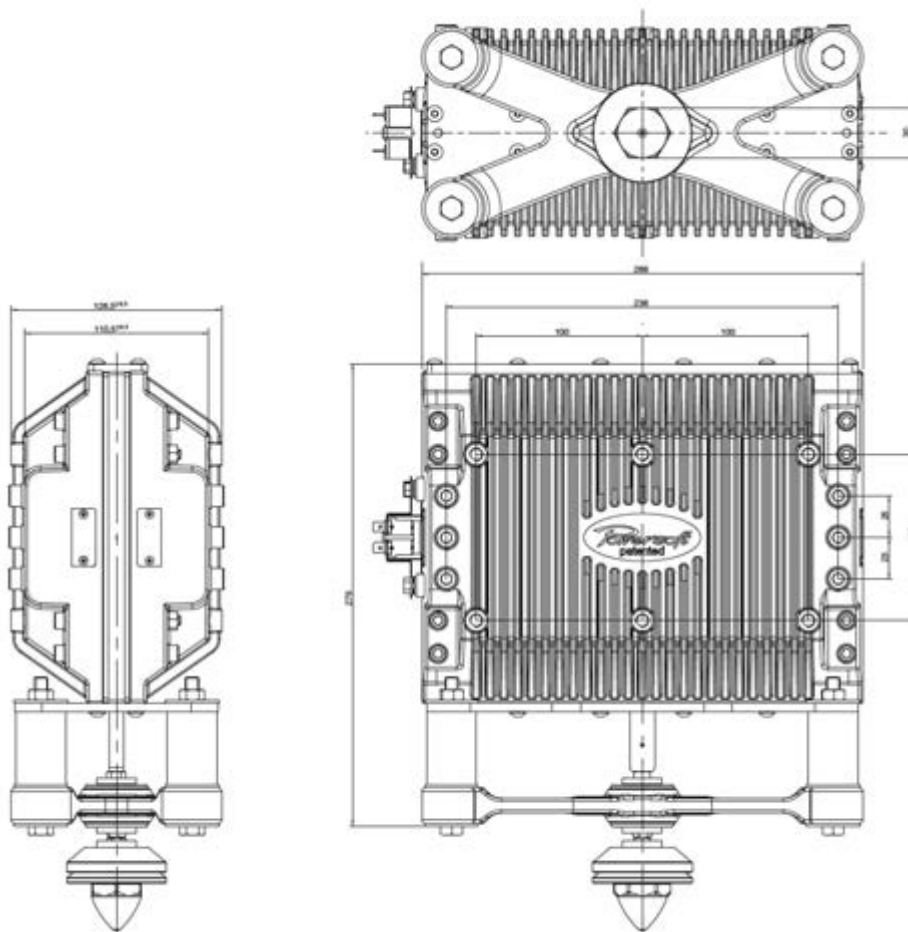
device would be, in itself, a remarkable concept, combining an original design with a complete rethinking of the applications, which the DEVA addresses. However, Powersoft also refined the electronic design to minimize power consumption, enabling uninterrupted use, powered by an internal rechargeable battery that can be quickly recharged using a latest-generation solar panel.

We highly recommend a look at the DEVA. It has a multiple enclosure finish that emphasizes its exquisite raindrop-shaped design that is specifically intended to protect the internal circuitry from exposure to the atmospheric elements, making it an ideal solution for outdoor applications (IP 65). The DEVA system even features a GSM/UMTS communications module, GPS, dual band Wi-Fi, Bluetooth, and wired Ethernet connectivity.

Inside, we find Powersoft's renowned Class-D amplifier modules, making the DEVA a unique solution for background music and paging applications, combined with video and/or audio surveillance.

This project is a fine indicator of Powersoft's engineering department's capabilities and willingness to bring to market. It also serves as the ideal introduction to the topic of this R&D article. But first, we need to examine some of Powersoft's fundamental technologies.

The M-Force transducer features “push-pull” technology, an extremely powerful motor, and unique displacement capabilities.



Rethinking the Audio Chain

Powersoft was one of the first companies to successfully introduce pulse width modulation (PWM) technology in a way that enabled its products to achieve a previously unthinkable level of efficiency and power, with power factor correction (PFC) technology integrated into switching mode power supplies.

Synonymous with Powersoft's beginnings in 1995, this technology was gradually adopted in professional audio applications worldwide due to its extremely high efficiency, which enables it to transform all the energy drawn from the mains into usable power and recycle the reactive energy coming back from the loudspeakers (back EMF energy recovery, which typically can be damaging for traditional linear amplifiers). The combination of those technologies produces equipment with useful features for touring and fixed installation equipment, allowing for a drastic reduction of the required energy for the same output power, less energy wasted on cooling systems, and certainly fewer amplifiers in less space.

Powersoft has previously used PFC to improve performance and contain mains current draw and consumption, enabling 40% energy savings and important efficiencies including the size of the electric generators used in shows and fewer cable sections due to lower RMS currents, which in turn allows for less hum and induced distortion. PFC-

based audio amplifiers also seem to be immune to mains voltage fluctuations and load impedance since the power supply automatically regulates itself, allowing amplifiers to be used worldwide, whatever the mains voltage.

Powersoft also leveraged the benefits of Smart Rails Management (SRM) technology. In any amplifier output stage, the efficiency is a function of the difference in the output voltage delivered to the load with the rails voltage delivered from the power supply. This is true for any amplifier topology but Powersoft's SRM implements real-time voltage tracking in the power supply, minimizing the differences between the output voltage rails voltage to improve overall efficiency. The SRM system feeds back the output signal to the power supply and modulates the rails voltage to reduce heat dissipation and improve efficiency, which includes reducing switching losses and EMC problems. It also provides a noise floor reduction on the output stage.

But the PWM technology, the PFC, and the SRM were only the beginning for Powersoft. The Italian company gradually gained recognition because of its lightweight, high power, Class-D amplifiers with reliable “green” credentials, and the company's ability to continuously innovate new products.

Year after year, Powersoft introduced smaller, lighter amplifier modules and racks, gradually introducing advanced DSP modules, network connectivity, and management software. Signal

Powersoft's DEVA automated audio messaging and video device is a remarkable engineering feat, demonstrating the Italian company has more to offer than amplification.



processing in the digital domain enabled Powersoft to modify the audio response to optimize its own products' audio quality and efficiency. Powersoft also designed more complex systems and increased its products' market appeal by providing integrated processing tools in response to the needs of speaker manufacturers and audio engineers.

Powersoft was also one of the first amplifier manufacturers to experiment with networked

control and software tools. First, it introduced KAESOP, an optional board for its popular K Series and Installation amplifiers for remote control and audio networking. The company also experimented with combining Ethernet protocol for remote control functions with a recognized digital audio protocol (e.g., AES3) to use the same CAT5 cable remote control and two channels of AES3 audio, which can be converted to four analog channels. Even before other audio networking protocols became popular (e.g., Audinate's Dante, which Powersoft currently implements), Powersoft was already pioneering software for remote control and monitoring for all its products.

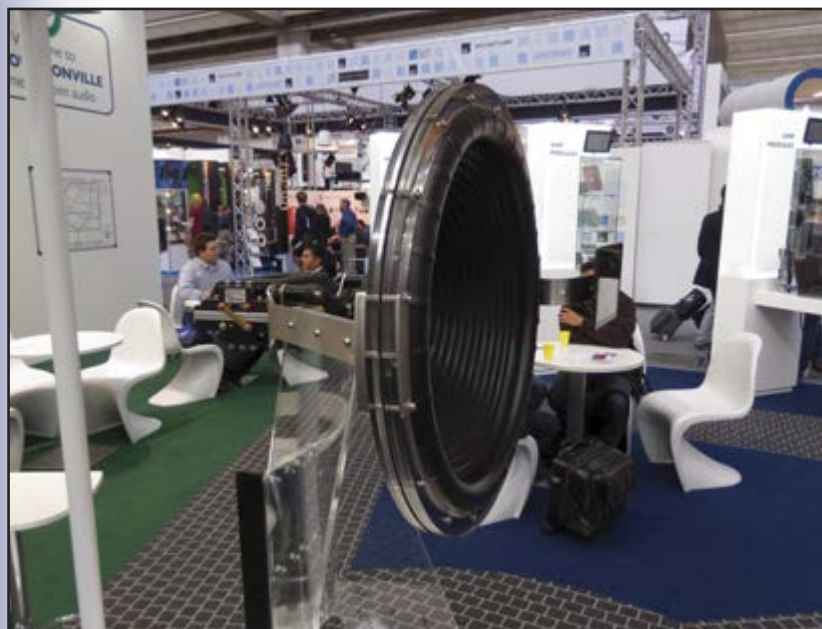
Powersoft's Armonía is a fine example of total system integration, offering full online or offline system setup and tuning, real-time management and monitoring of all vital functions from a remote computer (and now mobile devices) via a single intuitive graphical user interface (GUI). Above all, Powersoft's software offered another way to significantly improve sonic performance and system reliability, allowing for innovations such as Active Damping Control to compensate for speaker wire losses and improve cone control with a virtually negative output impedance, and efficiently limit the amplifier's output power at safe levels depending on the varying load impedance over frequency.

So, it's not surprising that Powersoft invests more than 10% of its turnover in research and development, encouraging experimentation. The company believed in active speakers and it pioneered its technologies in amplifier modules that could be integrated into the speakers. All those things were the necessary prelude to the company's M-System project, which started in late 2008.

Revolutionary New Concept

Next, Powersoft started working on a new amplifier module, the M-Drive (originally called the SUB-Drive) and the patented differential pressure control (DPC) concept, allowing for close integration between the amplifier and the speaker. The concept was originally named IPAL, which stands for Integrated Powered Adaptive Loudspeaker, and consists of "a combination of a high-power, high performance Switching Mode Amplifier in conjunction with an embedded DSP that performs the double operation of both managing the loudspeaker system processing and taking care of the Differential Pressure Feedback Loop Control implemented on it."

Powersoft introduced this concept in 2011, at the 131st Audio Engineering Society (AES) convention in New York, presenting a paper titled "Practical



Powersoft displays the M-Force concept as an innovative and unique transducer based on a patented moving magnet linear motor structure at Prolight+Sound 2013 in Frankfurt, Germany.