

CINEMA TECHNOLOGY

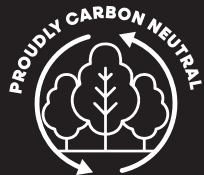
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A NEW DAWN?

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content and a new norm.



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- THE CASE FOR SELF-POWERED LOUD SPEAKERS



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SPEAKERS

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The Case for Self-Powered Loudspeakers

WORDS: MARK MAYFIELD, DIRECTOR OF CINEMA MARKETING, MEYER SOUND

Imagine buying a car, only to find it has no engine. Or buying a toy with “batteries not included”. They won’t work without these critical parts, and you have to select and purchase these parts separately. Now you have a whole new set of decisions to make. What do you do? How do you know which engine works best with your car, or which size/voltage batteries to buy, and how many? While this seems like an oversimplification, this is often similar to shopping for a sound system. But it doesn’t have to be this way.

In the early days of electronic sound, radios, television sets, record players, electric guitar amplifiers, computer loudspeakers - almost any device that made sound - contained both a loudspeaker with an amplifier attached to or inside it. It was so convenient; just plug it in, connect your source, and it worked. Over time, they separated. Why?

Part of the answer has to do with the need for greater sound pressure levels. In the early days of home Hi-Fi, and later professional audio, increasing amounts of amplifier power (wattage)

LOUDSPEAKER TERMINOLOGY

Speaker: someone who’s talking.

Transducer: a device that converts energy from one form to another.

Loudspeaker: a system that is used to reproduce sound from an electronic signal.

Driver: an individual transducer component of a loudspeaker that covers a limited frequency range. It converts electrical power into mechanical and then acoustic energy.

Signal Processing: analyzing and modifying an electronic signal.

Amplifier: a device that converts a low-level signal to a higher level (larger) one.

were required to push loudspeakers to the appropriate level for their given application. High power amplifiers depended on large, heavy transformers to convert the AC voltage to the correct level for the amplifier’s power supply. They also generated a lot of heat - especially vacuum tube designs - which sometimes required large heat sinks for thermal dissipation. For these reasons, it became more practical to separate the amplifier from the “passive” loudspeaker enclosure (no integrated electronics), especially for larger, high output systems.

As the power amplifier industry grew, so did the number and variety of model options for both home Hi-Fi and the pro audio markets. At the same time, loudspeaker brands proliferated. With so many options, it became even more challenging and time consuming to select the right power amplifier to pair with a given loudspeaker for a specific application. Power handling also became an issue: every driver in every loudspeaker has an inherent limit on how much power it can take. Some drivers, like those in low-frequency loudspeakers or ►

subwoofers, can handle lots of electrical power. Others, like the ones in high frequency drivers attached to horns, can handle much smaller amounts of power.

Applying too much power to a driver can damage it, and too little can cause you to overdrive the power amplifier (to produce the

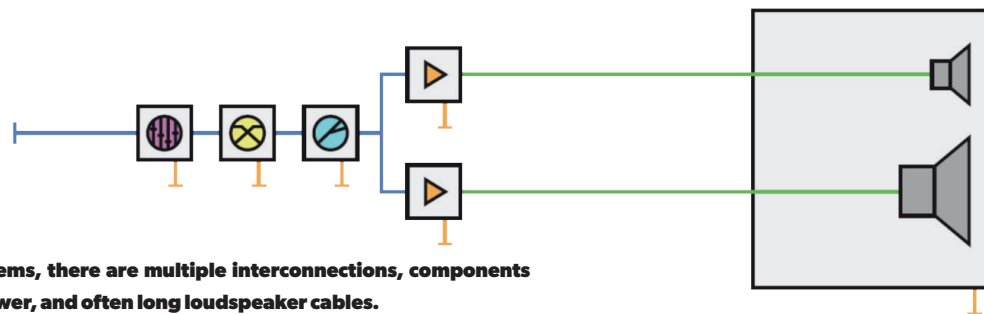
desired volume), leading to audible clipping distortion, and eventually, damage to the driver itself.

So you would need a variety of amplifiers depending on the specifications of each component in a multi-way loudspeaker system (2-way, 3-way, 4-way, etc.). Multi-way

loudspeakers also require other signal processing like frequency dividing networks (or crossovers) to route the correct band of frequencies to the appropriate driver that's best equipped to handle it. Yet another component to select, connect, and (in many cases) adjust and configure.

FIGURE 1

- LINE LEVEL
- POWER
- LOUDSPEAKER
- EQUALIZATION
- ACTIVE CROSSOVER
- COMPRESSION/LIMITING
- ▶ AMPLIFIER



In passive loudspeaker systems, there are multiple interconnections, components that require their own AC power, and often long loudspeaker cables.

Advanced technology to the rescue

Over the last 50 years or so, amplifier topologies such as class D (or “switching”) amplifiers made it possible to eliminate or minimise large, heavy

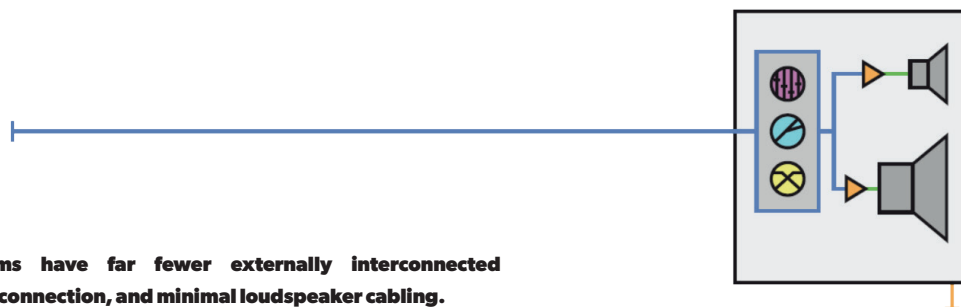
transformers, so amplifiers became significantly lighter and smaller.

It became practical to once again restore the amplifier to where it has always belonged: integrated with the loudspeaker enclosure.

Adding signal processing circuitry like crossovers, limiters, equalisation can also be easily integrated, simplifying system design and ensuring the best possible match of electronics and loudspeakers.

FIGURE 2

- LINE LEVEL
- POWER
- LOUDSPEAKER
- EQUALIZATION
- ACTIVE CROSSOVER
- COMPRESSION/LIMITING
- ▶ AMPLIFIER



Powered loudspeaker systems have far fewer externally interconnected components, a single AC power connection, and minimal loudspeaker cabling.

While self-powered (or active) loudspeakers have soared in popularity in recent years for nearly every pro audio application you can think of, this has not been the case in cinema sound.

One reason is based on tradition and practicality. Traditional practice has been to locate amplifiers in the projection booth, sometimes hundreds of feet from the loudspeakers they power behind the screen and along the walls.

In the booth, a projectionist could monitor

the amplifiers to make sure each amplifier channel was functional and getting the correct signal. This assumed, of course, that a projectionist was always nearby.

Times have changed, and these traditions have become less valid. No longer is there a projectionist at every site. Even when there is one, modern mega-complexes make it a challenge for a single projectionist to regularly monitor all screens in the sprawling projection alleys which sometimes span great distances.

One great benefit of the transition to digital projection has been the adoption of networking technologies in cinemas, allowing DCPs and other content to be delivered over networks. Cinema sound systems can also become networked, enabling centralised monitoring and control of many components, including power amplifiers and loudspeakers. The need for booth-located amplifiers has been greatly diminished.

The time for self-powered loudspeakers in cinema has come. **CT**

WHY SELF-POWERED?

There are many inherent benefits to fully integrated system design. Here's just a few

NO GUESSWORK:

Since self-powered loudspeakers incorporate amplification, you'll never have to deal with matching loudspeakers to amplifiers or connecting components. With the amplifier and signal processing built-in and matched to the loudspeaker, there are a closed set of defined variables, such as driver performance limits, enclosure volume, and acoustic performance. Manufacturers can fully optimise all components for maximum performance.

EASE OF DEPLOYMENT:

System set-up is much easier when you have fewer components and fewer cables to worry about being miswired. You don't have to spend a lot of time on calibration of gain and crossover settings or miswired driver polarity. Because amps are built into loudspeaker cabinets, there's no need for long, expensive lengths of loudspeaker cable from the projection booth to the loudspeaker, which can cause distortion and signal loss.

PREDICTABLE, RELIABLE OPERATION:

Because individual components have been optimised during manufacturing, you can expect consistent sound from loudspeaker to loudspeaker, from screen to screen. Built-in, factory-optimised protection circuitry eliminates the possibility of distortion without degrading signal quality. And, when you have less equipment and fewer interconnections, you have greatly reduced risk of failure.

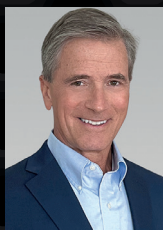
SUPPORTS "BOOTHLESS" CINEMA DESIGN:

With the amplifiers built into the loudspeakers, there's no need for large amplifier racks, enabling more efficient building designs that save space and reduce construction and HVAC costs.

The case for self-powered loudspeakers in cinema sound systems is not just a matter of convenience but a forward-thinking solution that addresses both technical and practical challenges. By integrating amplifiers and signal processing directly into the loudspeakers, cinemas can simplify system setup and enhance reliability. This innovation eliminates the complexities of matching and connecting separate components whilst supporting the potential of boothless cinema designs, paving the way for more efficient, cost-effective theater layouts. As cinema technology continues to evolve, embracing self-powered systems ensures a future where sound quality and operational efficiency go hand in hand.



▼ About the author



MARK MAYFIELD HAS AN EXTENSIVE BACKGROUND IN PRO AUDIO, AV, AND CINEMA, INCLUDING SALES, MARKETING, AND PRODUCT DEVELOPMENT. PRIOR TO JOINING MEYER SOUND, HE WAS DIRECTOR OF GLOBAL CINEMA MARKETING FOR QSC AND JBL. HE HAS ALSO SERVED AS EDITORIAL DIRECTOR FOR SEVERAL MAJOR TRADE PUBLICATIONS INCLUDING SOUND & VIDEO CONTRACTOR, PRO AV, AND WAS FOUNDING EDITOR AND CO-CREATOR OF AV TECHNOLOGY MAGAZINE, FOCUSING ON THE CONVERGENCE OF AV AND IT. MARK HAS PRESENTED CINEMA SOUND SEMINARS IN EUROPE, ASIA, AND NORTH AMERICA. HE IS CURRENTLY PRESIDENT OF THE INTERNATIONAL CINEMA TECHNOLOGY ASSOCIATION.

