



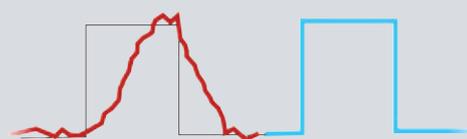
paragon 3D+ sound system

The paragon 3D+ sound system breaks new grounds in two ways. On the one hand, the entire system has been consistently developed to feature fully digital signal transport right up to the point of sound transduction, thereby allowing for unprecedented sound quality. On the other hand, this new approach is based on a novel system architecture that utilizes a modular design.

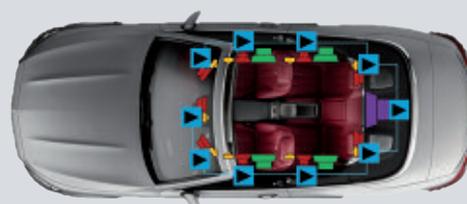
The use of numerous identical and networked modules enables the sound system to be flexibly scalable, resulting in significant weight reduction (up to 50%) and lower material costs (up to 30%). In addition, it is simple and straightforward to incorporate further innovative functions into the system.



Fully digital signal transport



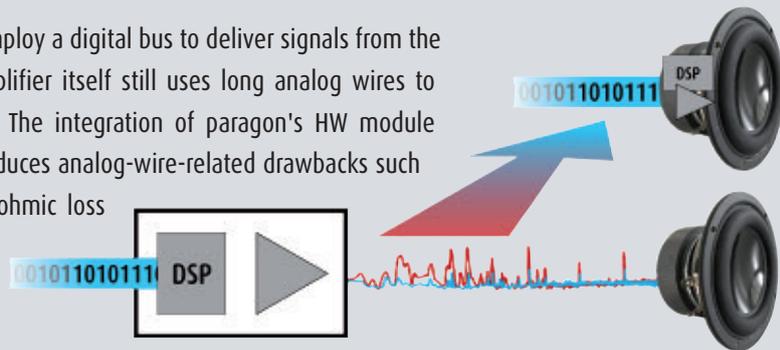
Perfect signal quality



Modular, scalable system architecture

Perfect sound quality through consistent digitization

Although current sound systems employ a digital bus to deliver signals from the headunit to the amplifier, the amplifier itself still uses long analog wires to drive the corresponding speakers. The integration of paragon's HW module directly into the speaker chassis reduces analog-wire-related drawbacks such as excessive weight, EMC issues, ohmic loss as well as inductivity and capacity per unit length down to virtually zero.



This design permits maximum precision in terms of speaker control: The very latest equalization procedures, designed to obtain a linear frequency response and a time correct reproduction, are now enabled to be accurately and precisely applied like never before. Additionally, new features such as monitoring and protection functions, along with the linearization of speaker dynamics, are combined with unsurpassed robustness to meet the requirements of the automotive sector. The speaker chassis, which continues to be the weakest link in the transmission chain, consequently gets upgraded significantly.

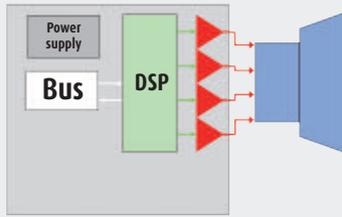
An even better 3D sound experience: 3D+

Conventional sound systems usually attempt to distribute sound to the whole vehicle interior as uniformly as possible, but are forced into various compromises due to the typical seat and loudspeaker arrangement: At first, there is the risk of rear seat passengers being subjected to excessive volume emitted by the rear speakers whenever the driver wants to enjoy adequate surround sound. Vice versa, there is the likelihood of the driver being deafened if those rear seat passengers want to hear what is coming out of the front speakers. The need to avoid these undesirable effects leads to largely restrained tuning of such 3D and surround sound systems in vehicles, thereby reducing the available listening pleasure.

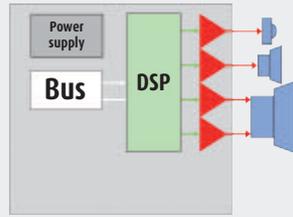
Using modular components, paragon provides a straightforward way of unlocking the corresponding multi-channel reproduction potential: Providing surround and 3D height speakers individually for each seat along with suitably split signal processing, paragon's upmix algorithm creates an individual 3D sound experience for each individual occupant without disturbing the others. The previous reluctance to mix three-dimensional sound effects can thus be overcome. The passengers of paragon's specially equipped show vehicle are enabled to experience a real emotional "Plus" of 3D sound.

Modular system: One for all

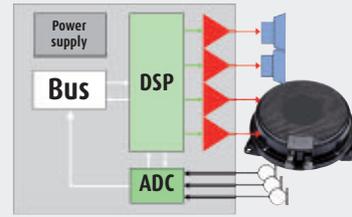
A single module for all applications: paragon's modular system breaks the familiar mantra of a central amplifier requiring large installation space, a spider's web of speaker wires and heavyweight heat sink to deal with the generated heat. The key component is a flexibly configurable HW module, networked with other identical modules via a digital bus (e. g. HDBaseT, A²B, AVB).



Subwoofer



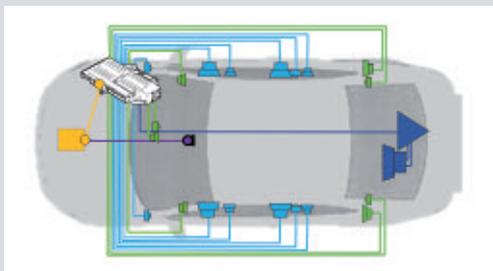
Three-way door module



Seat module, e. g. for headrest speakers, microphone connection, sound massage etc.



While the module itself unifies bus nodes, DSP and amplifier, the total number of modules allows the size of the system to be scaled accordingly. The functional diversity of the system can therefore be expanded by increasing the number of implemented SW modules, regardless of other considerations. If the system consists of numerous modules, complex algorithms can be distributed via multiple processor cores operating in parallel, thereby maximizing available computing power and minimizing latencies. As the system relies on a single type of HW module (which only needs to be developed once), various system implementations do not result in any additional development or approval costs, except adaptation efforts. Economies of scale likewise reduce the cost of materials.



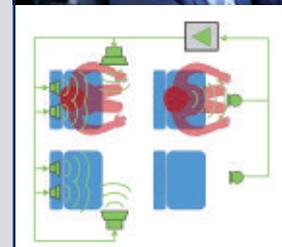
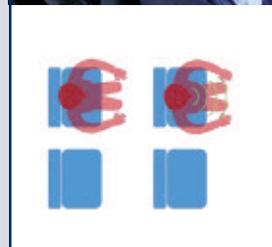
High-end sound system of conventional design installed in a vehicle currently on the market



The same vehicle with the same speakers but equipped with paragon system architecture

Additional innovative functions

While the further development of current sound system architectures is limited by low scalability and high costs, it is easy to add further innovative functions to the paragon system by integrating additional SW modules such as in-car communication (ICC). Communication between the occupants of a car is often difficult (e.g. in an open-top convertible, with opened windows or sunroof, or when the vehicle has three seat rows) and may distract the driver.



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To ensure optimum communications, paragon's tried-and-tested seatbelt-mounted belt-mic[®] microphones are integrated into the vehicle. Smart algorithms and surround sound speakers incorporated into the headrests facilitate trouble-free conversation between all the vehicle occupants in any driving situation. The same approach allows us to add additional functions such as vehicle noise compensation (ANC, EOC), engine sound synthesis (ESS) and so on while retaining the capability to implement a standalone solution based on one single module. This allows retrofit concepts as well as integration into existing bus systems.

Show vehicle implementation

The conceptual and audio-qualitative advantages of our modular system are amply demonstrated by our show vehicle.

A total of 34 speakers are controlled by modules distributed around the vehicle, which supposes – in comparison to wiring to a conventional central amplifier – the elimination of almost 400 feet (120 meters) of speaker wires. Instead of creating a central hotspot, we use highly efficient class-D amplifiers, with such limited power loss that, for example, even a small speaker magnet provides sufficient heat dissipation. The close proximity of the amplifiers to the speaker voice coils cancels the need for DC/DC converters which also helps to eliminate the familiar EMC-related issues associated with them. It is instead possible to operate with high currents directly at the on-board voltage level, thereby increasing overall efficiency.

Technical properties

Usage	From entry-level (five stereo speakers) to perfect 3D+ high-end audio (based on 5.1+4 ^{**})
Audio	<ul style="list-style-type: none"> - Semantic upmix of stereo to 5.1 or 5.1+4 - Use of native surround and 3D content (demonstrable) - Individual surround and 3D sound experience on each seat - Outstanding signal reproduction quality
DSP/amplifiers	<ul style="list-style-type: none"> - Distributed HW modules - Class-D amplification directly at the speaker
Signal control	Perfect equalization and linearization of speaker properties
Loudspeakers	Adaptation of all types by suitable measurement and the use of new SW algorithms
Overall	<ul style="list-style-type: none"> - Fully digitized signal transfer to the speaker - Virtual elimination of analog audio cables - Optimized costs, weight and installation space - Modular concept (HW, SW), individually adaptable

Demos on request: You can experience the above-mentioned functions on request at any time.

^{**}5.1+4: typically consisting of five surround-sound speakers in the dashboard and doors, one subwoofer and four 3D speakers in the headliner and individual headrests