



INVISIBLE LOUDSPEAKER APPLICATION STUDY

# MULTICHANNEL SURROUND SOUND

— Invisible Home Cinema Systems —

*amina*



Private Residence, United Kingdom - Invisible Atmos system

## Invisible Surround Sound

Multichannel surround sound systems are often thought of as one of the most demanding applications when it comes to integrated loudspeakers. The selection requirement is typically for a loudspeaker that will be able to effortlessly handle the dynamic subtlety of a movie soundtrack from the most delicate soundscapes to the largest of explosions, all while providing incredible sound localisation to give a truly enveloping audio experience.

It is a common misconception that a Vibrational Panel Technology (VPT) loudspeaker is not capable of providing an incredible multi-channel experience. Concerns over sound localisation, bandwidth capabilities, maximum SPL and power handling are all hurdles that will inevitably cause a system integrator to think twice when it comes to an 'invisible' surround sound system. While all of these points should be paid consideration when specifying a multichannel system, it is not the case that an Amina loudspeaker will underperform in any of these areas.

Although Amina speakers may not be the appropriate choice for every dedicated home theatre, there are incredible sound and design benefits that can be gained from switching to a flat panel speaker. Whether you are specifying a basic 5.1 system all the way up to a 32-channel immersive home theatre, Amina speakers are a perfect choice.



Private Residence, London, UK - Surround sound system



Super Yacht - In-ceiling speakers in panelling and behind bed

## Multi-use Spaces

The majority of multichannel surround sound systems are not typically found in a dedicated home theatre space. More often, they are located in the rooms we entertain, socialise, sleep or work in. These spaces will usually be functional or leisure areas not solely designed for the consumption of movies or multi-channel music. Considering that a basic multichannel system might consist of five speakers and a subwoofer all the way up to in excess of eleven speakers and multiple subwoofers for an immersive cinema system. The introduction of multiple visible loudspeakers can very rapidly prove to be unsightly, visually intrusive and difficult to fit into modern decor as well as taking up valuable floor or wall space.

Paired with a hidden projector, lighting control and a retractable screen, Amina invisible loudspeakers can allow any room to transform into an incredible home theatre at the push of a button.

Whether your multichannel system is disguised as a living room, kitchen, bedroom, swimming pool bathroom or even your office, you can be sure that it will be ready to for you unveil its full potential as soon as you need it.

## Audio Benefits

An Amina invisible surround sound system not only impresses due to its ability to seamlessly transform an ordinary room into a media centered space, it can also provide a number of acoustic benefits often outperforming its traditional loudspeaker alternative.

Amina VPT loudspeakers produce a natural and immersive room-filling sound in two ways; a full-bandwidth hemispherical dispersion pattern (180° even at high frequencies), and an incoherent-phase waveform. While these two characteristics in isolation might make for a less than perfect home theatre system, when combined, they allow the listener to become bathed in sound.

### Coherent vs incoherent-phase waveforms

A conventional loudspeaker, using an electromagnetic transducer to move a cone forwards and backwards in a 'piston' motion, creates what is known as a coherent phase waveform. The movement of the cone has a direct relationship to the fluctuating voltage that is delivered to the loudspeaker. This creates an 'accurate' waveform, but issues can arise when more than one sound source is introduced. This could either be two or more loudspeakers, or even a single loudspeaker and the reflected sound from a wall or ceiling. When multiple coherent-phase waveforms meet, they will interact in either a constructive or negative way. Exactly how they

interact will depend on timing differences between the two sound sources and the frequency of sound that is interacting. Because the interaction is frequency specific, it will cause a tonal change to the perceived sound. Phase interaction is the reason why time-aligning multiple loudspeakers is important within a multichannel AVR. The one downside to time alignment of coherent-phase sources is that it only works for one specific listening position in the room. Every other position will receive an imperfect frequency response.

VPT loudspeakers use a similar electromagnetic transducer (known as an exciter), but instead of driving a cone, it is coupled directly to a flat panel. As the fluctuating voltage moves the panel in and out on a microscopic level, vibrations radiate out from the drive point and emit audible acoustic energy from the entire panel surface. The panel can be thought of as a continuous field of an infinite number of sound sources; each point radiating with unique phase and timing information. All these interactions combine to form a complex, but highly detailed waveform, which the brain decodes to hear as high-fidelity sound. This type of acoustic signal is known as an incoherent-phase waveform.

When multiple incoherent-waveforms interact, the perceived effect of phase interaction (and tonal colouration) is greatly reduced.

Combining the incoherent-phase waveform with the full-bandwidth 180° dispersion pattern of the loudspeakers means that even with a high channel-count audio system (consisting of multiple sound sources), the tonal response is even across the entire space, not just focused on one specific sweet spot.

With an even frequency response across the whole listening position, listeners do not have to fight for the sweet spot in the middle of the room. No matter where the listener is positioned, they will always be on-axis to each loudspeaker in the system.

With recent advancements in VPT loudspeaker technology, an Amina multichannel surround sound system can provide an immersive and emotive listening environment that every listener can experience in the same way.

With high power handling full-bandwidth loudspeakers and discreet integrated subwoofers available from Amina, it is possible to have a totally hidden but very capable surround-sound system that will sound natural and dynamic with high SPL capabilities when needed.

## Construction Benefits

With a loudspeaker that has a full-bandwidth 180° dispersion pattern, there are a number of construction and design benefits that can allow a system-integrator to create an immersive audio system where they may otherwise not be able to.

While conventional positioning of loudspeakers should always be adhered to, there will be times when intelligent compromises need to be made, installing a loudspeaker in a less than perfect position. Given the even off-axis response of an Amina speaker, it is unlikely that sound quality will be affected when 'incorrectly' positioned. It is not a requirement to angle the loudspeaker or the wall towards the listening position.

When loudspeakers are installed in-ceiling above a screen, the listener will often perceive the sound as coming from the screen rather than the ceiling. With perfect off-axis response and lack of visual cues as to loudspeaker location, there is nothing to tell the listener that the sound isn't coming from where they would instinctively expect it to come from. The same illusion can be achieved with surround loudspeakers. An open-plan listening environment may not have wall space available to install rear surround speakers into. By installing in-ceiling, a full system can be achieved without having to rely on in-room satellite speakers, or unsightly conventional loudspeakers.

With a depth of less than 33mm, Amina flat panel loudspeakers can be installed where there is severely limited cavity space (minimum 25mm), where a conventional loudspeaker may not fit. With floor space at a premium, the ability to install a low-profile product without the need to build out false walls or lower a ceiling will help to maximise the space to its full potential.



MDU, London, UK - In-wall surround sound system

## Immersive Surround Sound

The rise of immersive audio formats such as Dolby Atmos, DTS:X and Auro-3D is truly starting to take the custom installation and home theatre sectors by storm. With content availability and delivery options increasing all the time, the technology is now more readily available to the everyday consumer.

Building on traditional multichannel formats, immersive or 3D surround sound systems include the addition of overhead height channels, allowing sounds to not only move around you within a room, but to also arc overhead. While each immersive format differs slightly in terms of system flexibility, playback options, channel count, bitstream decoding and additional processing, the aim of all of these systems is to deliver an engaging and enveloping listening environment.

An immersive multichannel system necessitates the use of increased speaker quantities. Therefore the ability to have a completely discreet loudspeaker becomes even more desirable.

Greater loudspeaker numbers will also increase the likelihood of running into spatial limitations. Amina speakers can be installed into a cavity wall with just 25mm rear cavity space behind the plasterboard, eliminating this problem.



Private Residence, Poland - In-ceiling surround system



Barn conversion, UK - Surround system built into lower wall sections

## AVR Calibration

As with all multichannel systems, it is important to correctly configure the AVR so that the audio is accurately reproduced as the content creators intended. It is important to match the capabilities of the AVR to the audio system. This includes both the selection and calibration of the AVR. It is important to calibrate the following:

- Loudspeaker quantity and layout
- Distance from each loudspeaker to the listening position
- Playback level of each loudspeaker at the listening position
- Polarity
- External amplification configuration
- Room correction (EQ)
- Bass management

Most AVRs will allow auto-calibration, however it is recommended to enter all parameters manually. Most built-in calibration systems will not always provide accurate measurements for a VPT loudspeaker. Correct manual calibration is simple and does not take long to perform.

Consider setting bass management, channeling low frequency content below 100Hz to the LFE output (subwoofer). This increases maximum power handling and improves system dynamics.

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