



GENELEC[®]

Immersive Solutions

3rd edition



Genelec Immersive Solutions

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A Perceptive Perspective

Hearing the world around us is so natural that we often only notice its importance once the ability is lost. Most of the time, a loss is fortunately temporary - for instance caused by a cold - but a one-side hearing loss is more stressful and depressing than we generally tend to believe.

One of the first things a baby does is to localise, quickly and automatically turning eyes towards a sound. Growing up, we further learn and refine localisation using a system under construction. Ear canals and other structures of the outer ear, known as pinnae, grow and reshape, constantly modifying spherical hearing, as we reach out and experience a fascinating world in return.

Sound is coloured by the pinnae, depending on its direction of arrival – known as azimuth. Expert listeners constantly use this feature in combination with head movements; not only when evaluating immersive content, but also to distinguish direct sound from room reflections.

The ability to position sounds spherically with precision is a key benefit of immersive audio. Another is the possibility to influence the sense of space in human listeners. For the latter, the frequency range between 50 and 200 Hz - which constitutes the lowest two octaves of the interaural time difference (ITD) range - plays an essential role; but is often compromised by the reproduction system.

A well-aligned loudspeaker system in a great room has the best chance of translating well to a variety of immersive playback situations, including headphones. The sound designer is able to make full use of outer ear features and head movements, and to work for long hours with reduced listener fatigue and “cybersickness”.



SHARPEN YOUR SENSES

Immersive Audio: The Background and The Formats

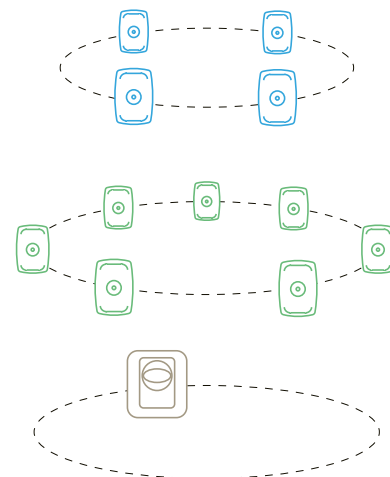
An immersive audio experience is created by employing playback with more loudspeakers than a traditional surround system. In standard terms, this means going from an ITU-R BS.775 monitoring configuration to ITU-R BS.2159.

In immersive, loudspeakers are located around the listener at ear level, but crucially also positioned above or below the listener, so called “layers”. Layers may or may not be reflected in format names, so the same setup could be labelled, for example, 11.1 or 7.1.4 depending on manufacturer or country. In either case that system would have 11 discrete main channels and one LFE channel.

The only reliable way to ensure reference-quality immersive monitoring is to adjust all monitors after placement for level, time-of-flight and frequency response. This is easy to do with a Genelec system; please see page 14.

Benefits of Genelec Immersive Monitoring Systems:

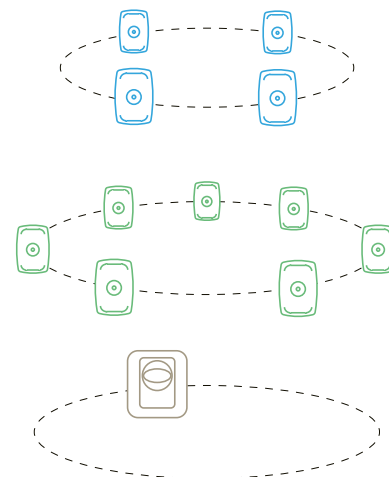
- Neutral and uncoloured sound, both on and off axis.
- A wide range of loudspeaker and subwoofer sizes, meaning that we can offer scalable systems for all room formats, from small OB vans to large dubbing theatres.
- All monitors in this brochure tightly integrate with the GLM software (included) to enable precise system calibration. GLM doubles as an integrated monitor controller.
- We provide versatile mounting options for easy positioning and aiming of loudspeakers.
- Rugged build quality, sustainably manufactured with bulletproof reliability.



Dolby Atmos

Launched in 2012, Dolby Atmos is a widely supported object-based system with up to 128 individual tracks and 64 speaker feeds.

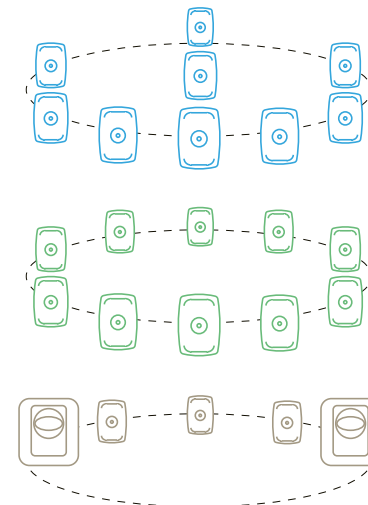
- Two layered system with both surrounds and height channels.
- Typically up to 7.1.4 Home reproduction, but larger speaker layouts are possible.
- Up to 64 discrete speaker feeds for Cinema reproduction.



MPEG-H Audio

Developed by MPEG for broadcast and streaming applications, the MPEG-H Audio system brings immersive sound and advanced personalization and accessibility features.

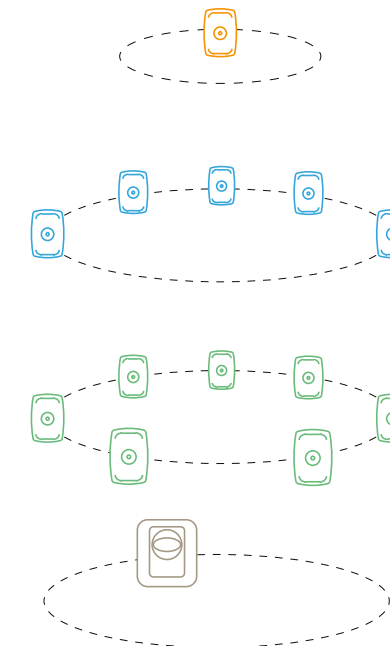
- The scalable architecture allows flexibility in number of channels.
- Audio Objects enable dialog enhancement and personalization.
- Empowers the creation and delivery of a high-quality immersive music experience.



22.2

Developed by Japanese broadcaster NHK, the three layer channel-based 22.2 system forms the surround sound component of NHK's ultra HD television system.

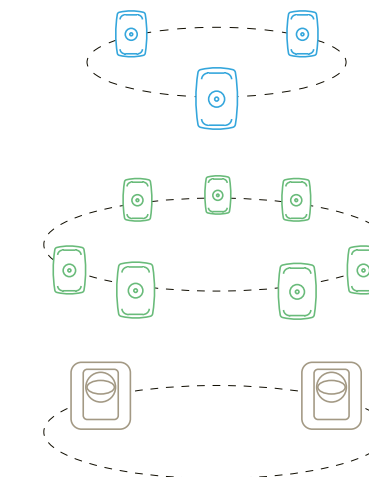
- Three layer system for broadcast and home use.
- Fixed number, fixed channel-positions for production.
- Full or condensed home reproduction systems.



Auro-3D

Introduced in 2006, Auro-3D is a channel-based three layer system which comes in a variety of formats.

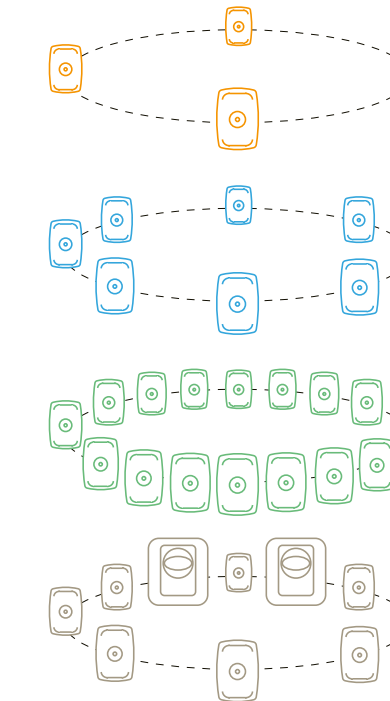
- Three layer system with surround, height and VoG channels.
- Typical formats from 7.1.2 to 7.1.6.
- Object-based 'AuroMax' extension for additional channels.



DTS:X

DTS:X was launched in 2015. Like Dolby Atmos, it is an object-based system - but without prescribed speaker configurations.

- Two layer system with surround and height channels.
- Audio rendering based on number and position of speakers available.
- Supports up to 32 speaker locations and 7.2.4 channels.



ITU-R and Pure Research

ITU-R is researching the requirements for realistic 3D sound for UHD TV. Pure research is focussed on in-room and binaural sound with and without movement.

- At least three vertical layers and one or more subs.
- Typically between 11 and 80 main channels.
- ITU-R is collaborating with NHK (Japan), SMPTE (USA) and EBU (Europe).

Research and Experimental Systems

Around the world, academic institutions and commercial organisations are engaged in extensive immersive audio research; an explosion driven by new hi-spatial distribution formats, and promises of commercial return for the first companies to solve the challenges of personal (binaural) delivery, i.e. to provide a credible, immersive headphone experience.

Satisfactory binaural delivery for film, gaming and VR does not rely only on presenting sources with azimuth, but also the reflections we always hear under natural conditions. Direct sound and reflections furthermore have to be rendered specifically for each individual listener, including real-time head and body movements. The processing burden on a binaural reproduction system is therefore significant, and the data it is built on must be as accurate as possible.

A fine immersive experimental system is at the heart of any subjective test and data gathering. In this respect, Genelec point source monitors, known as “The Ones”, are in their own category entirely. By avoiding the colouration of direct sound and reflections, which is not possible with a conventional monitor design, the most serious obstacle in immersive research is avoided. Not surprisingly, there has been a surge in microphone production and immersive studies based on The Ones.

For research where the requirement for ideal directivity in both planes is less pronounced, the range of Genelec models to choose from is wider. While a selection of these models appears within this brochure, please visit www.genelec.com for the full range, and notice how the benefits of GLM in-situ adjustments are available to all Genelec SAM monitors and subwoofers.





Genelec Immersive Room Solutions

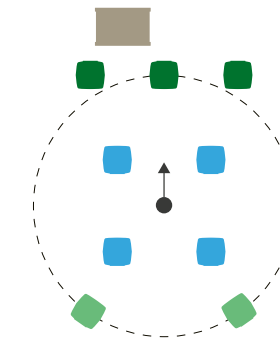
Compact 5.1.4

Application: OB truck or research installation

Typical listening distance: 0.7 m

Suggested Genelec System:

- **Main LCR:** 3 x 8330 or 8331
- **Surround:** 2 x 8330 or 8331
- **Ceiling:** 4 x 8330 or 8331
- **Subwoofer (LFE):** 1 x 7360



Mounting Accessories:
4 x 8000-420 short wall mount
2 x 8000-436 short ceiling mount

Cabling:
Analog or digital, e.g. 10 x AES/EBU
XLR cables

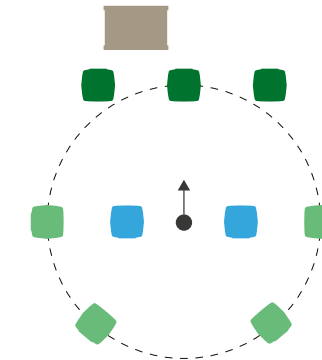
Small 7.1.2

Application: broadcast or continuity studio

Typical listening distance: 1.2 m

Suggested Genelec System:

- **Main LCR:** 3 x 8340 or 8341
- **Surround:** 4 x 8340 or 8341
- **Ceiling:** 2 x 8331 or 8341
- **Subwoofer (LFE):** 1 x 7370



Mounting Accessories:
4 x 8000-402 adjustable wall mount
2 x 8000-436 short ceiling mount

Cabling:
Analog or digital, e.g. 10 x AES/EBU
XLR cables

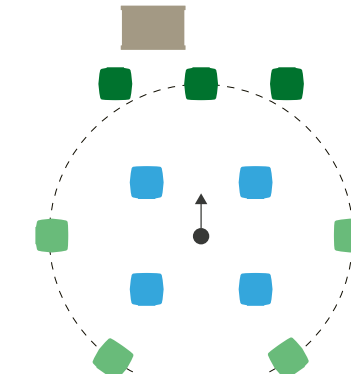
Small 7.1.4

Application: broadcast or post production studio

Typical listening distance: 2.0 m

Suggested Genelec System:

- **Main LCR:** 3 x 8351
- **Surround:** 4 x 8340 or 8341
- **Ceiling:** 4 x 8341
- **Subwoofer (LFE):** 1 x 7380



Mounting Accessories:
4 x 8000-402 adjustable wall mount
4 x 8000-436 short ceiling mount

Cabling:
Analog or digital, e.g. 12 x AES/EBU
XLR cables

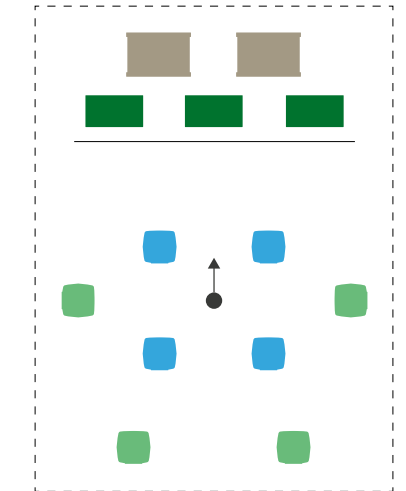
Medium 7.1.4

Application: post production or film commercial studio

Typical listening distance:
3.0 m front, 1.5 m others

Suggested Genelec System:

- **Main LCR:** 3 x 8361 or S360
- **Surround:** 4 x 8341 or 8351
- **Ceiling:** 4 x 8341
- **Subwoofer (LFE):** 2 x 7380



Mounting Accessories:
4 x 8000-402 adjustable wall mount
4 x 8000-436 short ceiling mount

Cabling:
Analog or digital, e.g. 13 x AES/EBU
XLR cables

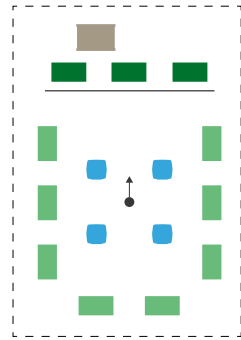
15 Channel

Application: post production or film commercial studio

Typical listening distance: 4.0 m front, 2.0 m others

Suggested Genelec System:

- **Main LCR:** 3 x 1238A/DF/AC
- **Surround:** 8 x 8361 or S360
- **Ceiling:** 4 x 8341 or 8351
- **Subwoofer (LFE):** 1 x 7382



Mounting Accessories:

- 8 x 8000-402 adjustable wall mount
- 8 x S360-424B U-bracket mounting adapter
- 4 x 8000-436 short ceiling mount

Cabling:

Analog or digital, e.g. 16 x AES/EBU XLR cables

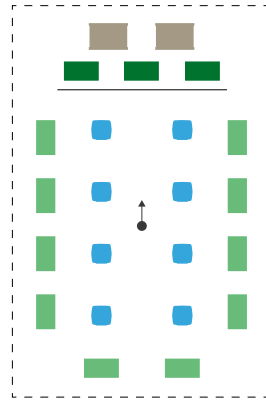
21 Channel

Application: film mixing stage

Typical listening distance: 5.0 m front, 3.0 m surround, 2.5 m ceiling

Suggested Genelec System:

- **Main LCR:** 3 x 1234A or 1234AC
- **Surround:** 10 x 8361 or S360
- **Ceiling:** 8 x 8351
- **Subwoofer (LFE):** 2 x 7382



Mounting Accessories:

- 10 x 8000-402 adjustable wall mount
- 10 x S360-424B U-bracket mounting adapter
- 8 x 8000-444 long ceiling mount

Cabling:

Analog or digital, e.g. 23 x AES/EBU XLR cables

Options:

Bass management and subwoofers for side and rear channels, e.g. 2 x 7380. In the case of digital interfacing, consider 2 x 9301 interface units

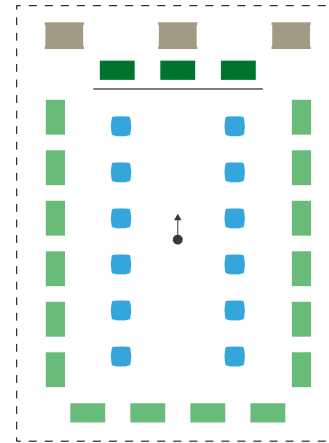
31 Channel

Application: film mixing stage

Typical listening distance: 8.0 m front, 5.0 m surround, 2.5 m ceiling

Suggested Genelec System:

- **Main LCR:** 3 x 1236
- **Surround:** 16 x 8361 or S360
- **Ceiling:** 12 x 8351 or 8361
- **Subwoofer (LFE):** 3 x 7382



Mounting Accessories:

- 16 x 8000-402 adjustable wall mount
- 16 x S360-424B U-bracket mounting adapter
- 12 x 8000-444 long ceiling mount
- 12 x S360-450B U-bracket mounting adapter
- 12 x S360-465B ceiling mounting plate

Cabling:

Analog or digital, e.g. 33-35 x AES/EBU XLR cables

Options:

Bass management and subwoofers for side and rear channels, e.g. 4 x 7380. In the case of digital interfacing, consider 2 x 9301 units



GLM Software: Configuration, Calibration and Control for Immersive Systems

Configuration and Calibration

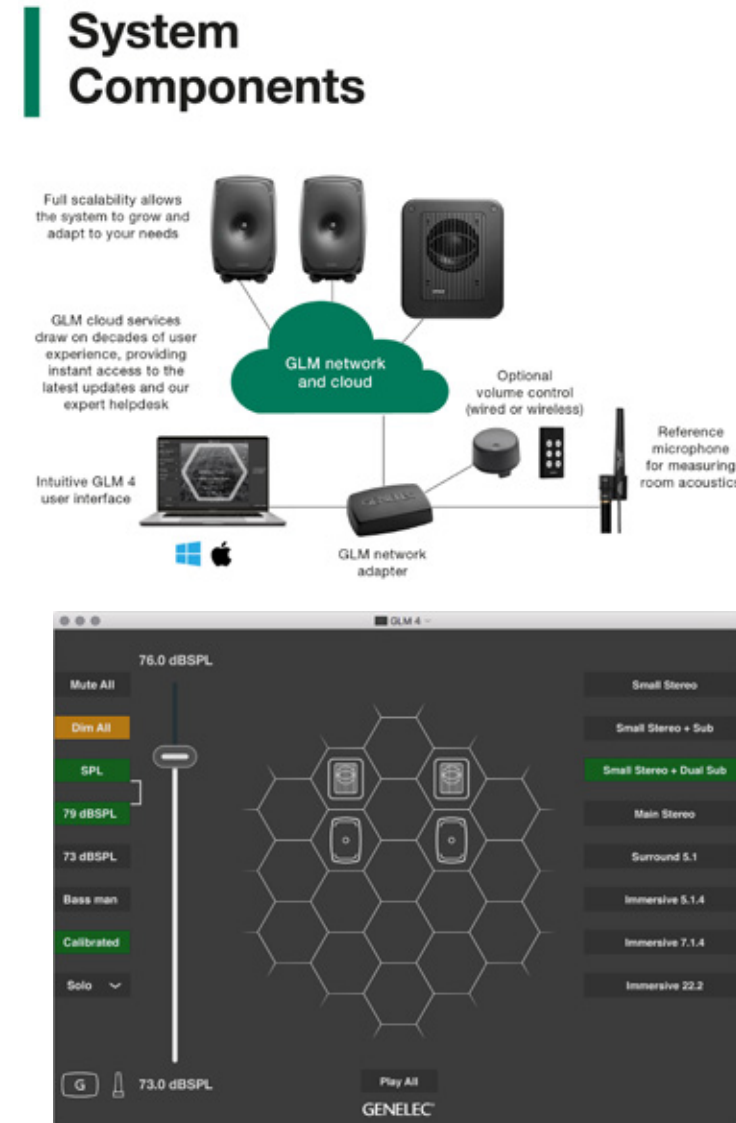
To ensure reference listening conditions and good translation between rooms or headphones, any monitor in any room needs to be adjusted after placement. Genelec's GLM application offers a sophisticated, integrated solution, based on decades of research combined with data from thousands of listening rooms.

When setting up an immersive system, calibration after placement is paramount. Otherwise, even the same type of monitors will exhibit different tonal balance. Monitors may also be at different distances from the listener; thereby causing further difficulty with level, delay and phase. During setup, GLM easily compensates for such problems. It allows further adjustment by the user to accommodate standards (e.g. X-curve), listening level or personal preferences, and it scales freely so more channels can be added.

Monitor Control

In daily operation, GLM doubles as a comprehensive Mac or PC-based monitor controller that immediately scales with your setup requirements; for instance if changing from stereo to 5.1, 7.1.4, 22.2, 64 channels or higher.

GLM enables you to calibrate your listening level to various loudness standards, and invoke solo and mutes. You can switch between formats, monitoring systems and primary listening positions, and move entire systems in time to retain sync with picture. The list goes on, and in each case your integrated GLM monitor controller won't burden Pro Tools or any other immersive playback device.

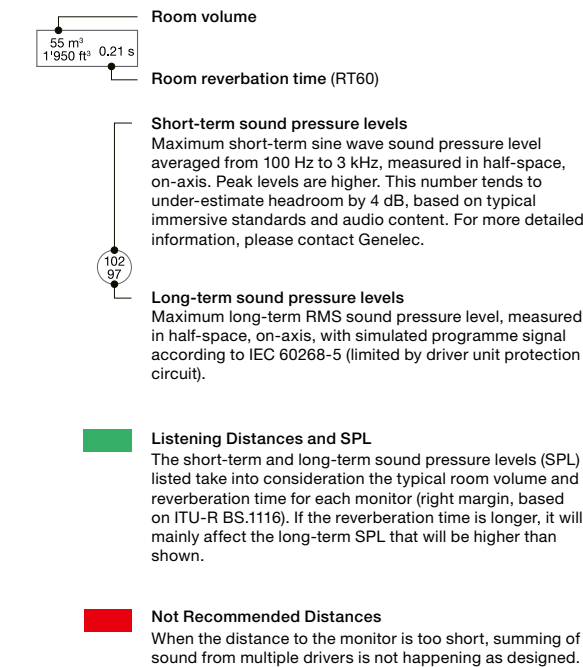


Monitor In-Room Performance

Listening Distance and Sound Pressure Level

The distance between you and your monitors is crucial, both in terms of performance and the SPL delivered to the listening position. Use the table here to compare the SPL capabilities of Genelec SAM monitors.

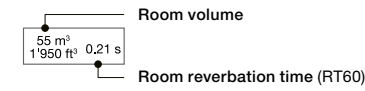
Also consider using the two Dolby Audio Room Design Tools (DARTD) for Home Entertainment and Theatrical production, including a wide range of Genelec models.



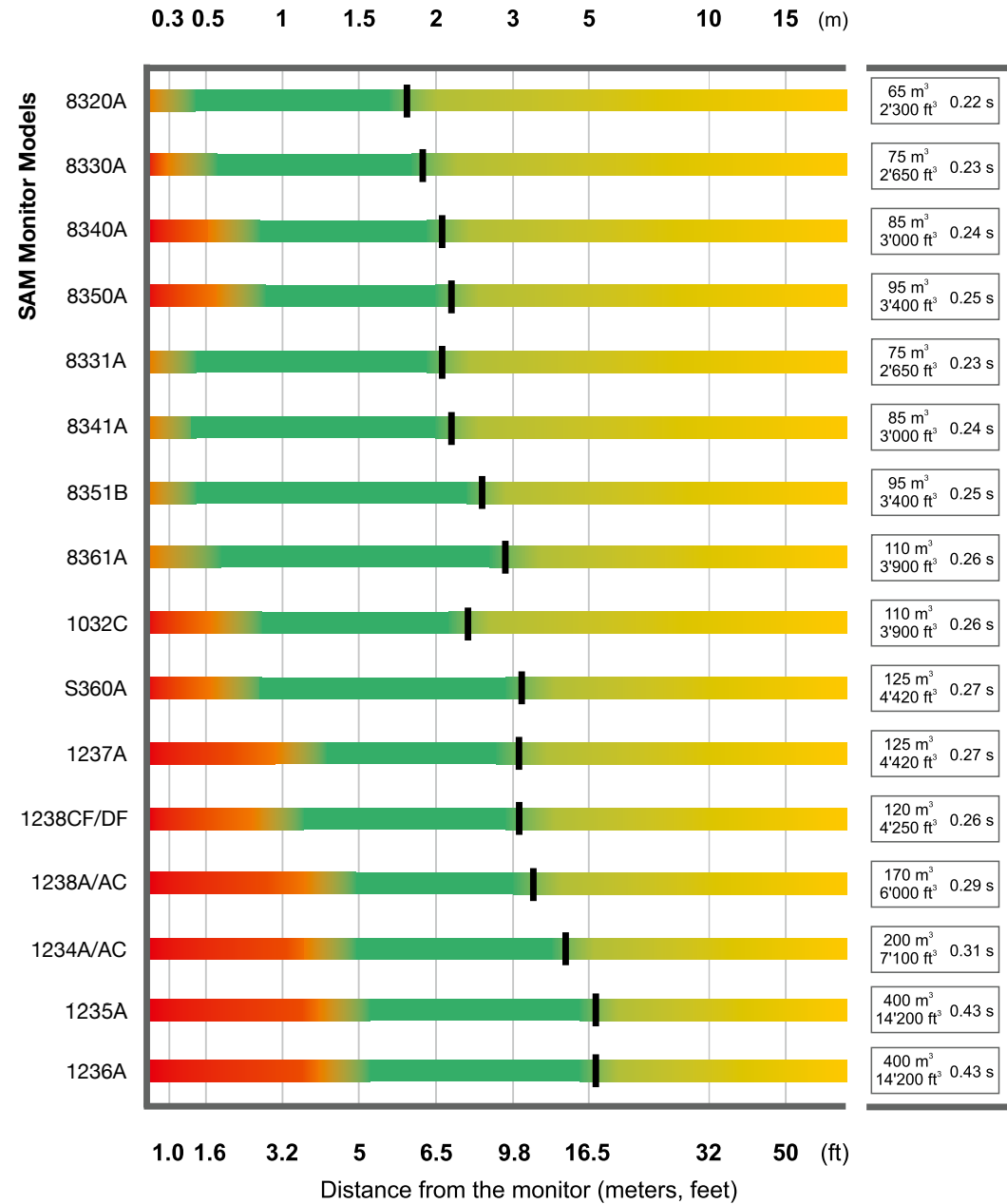
SAM Monitor Models	Distance from the monitor (meters, feet)							Room volume (m³ / ft³) and RT60 (s)
	0.5	1	1.5	2	3	5	10	
8320A	106/100	101/95	98/92	96/90	95/89	93/87	92/86	65 m³ / 2'300 ft³ / 0.22 s
8330A	110/102	105/97	102/94	100/92	98/90	97/89	96/88	75 m³ / 2'650 ft³ / 0.23 s
8340A	111/101	108/98	106/96	104/94	102/92	101/91	101/91	85 m³ / 3'000 ft³ / 0.24 s
8350A	113/104	110/101	108/99	105/96	104/95	103/94	103/94	95 m³ / 3'350 ft³ / 0.25 s
8331A	110/105	105/100	102/97	100/95	98/93	96/91	95/90	75 m³ / 2'650 ft³ / 0.23 s
8341A	116/107	111/102	108/99	106/97	104/93	102/93	101/92	85 m³ / 3'000 ft³ / 0.24 s
8351B	119/109	114/104	110/100	108/98	106/96	104/94	103/93	95 m³ / 3'350 ft³ / 0.25 s
8361A	124/115	118/109	115/106	113/104	111/102	108/99	107/98	110 m³ / 3'900 ft³ / 0.26 s
1032C	115/105	111/101	110/100	107/97	105/95	104/95	104/94	110 m³ / 3'900 ft³ / 0.26 s
S360A	118/112	115/109	113/107	110/104	108/102	106/100	106/100	125 m³ / 4'420 ft³ / 0.27 s
1237A	115/109	113/107	110/104	108/102	106/100	106/100	106/100	125 m³ / 4'420 ft³ / 0.27 s
1238CF/DF	112/102	109/99	107/97	105/95	105/95	105/95	105/95	120 m³ / 4'250 ft³ / 0.26 s
1238A/AC	116/111	113/108	110/105	108/103	108/103	108/103	108/103	170 m³ / 6'000 ft³ / 0.29 s
1234A/AC	120/115	117/112	113/108	111/106	110/105	110/105	110/105	200 m³ / 7'100 ft³ / 0.31 s
1235A	124/118	121/115	118/112	114/108	114/107	113/107	113/107	400 m³ / 14'200 ft³ / 0.43 s
1236A	124/119	121/116	118/113	114/109	114/108	113/108	113/108	400 m³ / 14'200 ft³ / 0.43 s

Direct Sound Dominance

The balance between direct and reverberant sound has a profound influence on how your mixes will sound. The table shown will help you identify the optimum range of listening distances for the Genelec SAM range.



- █ **Not Recommended Distances**
 When the distance to the monitor is too short, summing of sound from multiple drivers is not happening as designed, and this affects the flatness of the frequency response. A flatter and more stable frequency response is obtained by a larger distance.
- █ **Direct Sound Dominates**
 Within this distance the direct sound from the monitor has a higher level than the reverberant sound in the room. Placing the monitor within this distance range is advantageous in minimizing the tendency of the room reverberation to change the character of the monitored sound colour and affect the precision of stereo imaging. The level of the direct sound relative to the reverberant sound progressively reduces as the distance to the monitor increases.
- █ **Critical distance**
 The critical distance is the distance where the direct sound from the monitor and the reverberant sound in the room have equal level in midrange frequencies (approximately between 200 Hz and 4 kHz). The critical distance is affected by the room volume, the room reverberation time (referred to ITU-R BS.1116-1 Recommendation), and the directivity of the monitor.
- █ **Reverberant sound dominates**
 At these distances the reverberant sound in the room has a higher level than the direct sound from the monitor. This balance progressively increases as the distance from the monitor increases. The monitor can be used in these distances, but the sound character is strongly affected by the reverberation characteristics of the room, and this has a progressively increasing effect on the sound colour and stereo imaging accuracy.



Our Range of Monitors

Because Genelec offers such a wide range of monitors and subwoofers - each with the same consistently precise, neutral characteristics - it means that we can provide a professional solution for any type of immersive application, with a corresponding range of mounting accessories that is unrivalled in the industry.

From the smallest compact nearfield model via midfield three-ways to the largest full-size main monitor, whatever your room size, format and SPL requirements you can rely on a Genelec solution that will deliver exquisite and reliable performance day-in, day-out.

And because great translation between rooms and systems is so critical, it's reassuring to know that *"when you get it right on a Genelec, it's right everywhere."*

To see our complete range, please visit www.genelec.com



IMMERSIVE AUDIO IS A REALITY

Expert Advice for Your New Immersive Studio

Staffed by our team of global experts, the free Genelec helpdesk is here to guide you through the principles and practicalities of dimensioning and installing an immersive monitoring system for your music, broadcast, OTT or film production needs.

SIMPLY SEND YOUR QUERY TO
immersive.helpdesk@genelec.com

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the sonic reference

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