Genelec 8260A

Genelec has a new monitor with a coaxial driver. Genelec's CHRISTOPHE ANET and ILPO MARTIKAINEN describe the development of the MDC (Minimum Diffraction Coaxial) technology and the essential elements behind the 8260A DSP three-way system.

In principle, a three-way monitor offers clear sonic benefits, especially at higher sound levels, due to a separate midrange channel. If these benefits are desired, the designer has to choose between a small enclosure and no directivity control, and hence strong dependence of the listening environment, or a larger one, where proper directivity control can be included. The technical dilemma lies in the physical dimensions available for proper MF and HF directivity control.

Since the introduction of the 1022A in 1985, Genelec has approached this issue with waveguides, called DCW, having spaced mid and tweeter drivers. The DCW has proven to be a successful concept and it has been adapted by other manufacturers as well. With the aim of developing a smaller three-way product with limited physical dimensions, the traditional waveguide simply had insufficient space. The development started for a new coaxial driver that would combine MF/HF waveguide for directivity control.

Coaxial drivers are by no means new but the novelty is in eliminating the inherent response problems associated with their structure. The basic solutions at Genelec were developed in the late 90s to prototype levels.

Coincident-source loudspeakers provide advantages over spaced drivers, especially at the crossover region and improvements in imaging, response and directivity can be achieved. The basic principle of a coaxial driver is to place the high frequency driver at the apex of the low frequency diaphragm. Doing so, the apparent source location does not depend on frequency and the directivity of both drivers may be controlled in the crossover region. Furthermore, coaxial technology uses less front panel space than comparable designs with spaced drivers.

A very well known early coaxial design is the Altec Lansing 604 Duplex from 1941, which had two magnet circuits. The tweeter horn protrudes through the woofer magnet in front of the woofer cone. This product design has had a very long life span. Another very successful design was introduced in 1946, the Tannoy Dual Concentric. It has no visible separate tweeter horn, instead the curved woofer cone forms an essential part of the tweeter horn originating inside the woofer magnet pole piece. Originally this design also eliminated the tweeter magnet as the magnet circuit had two gaps, a larger one for the woofer cone and a smaller one in the rear for the tweeter. This design is still in production although modified in several details.

After neodymium iron boron magnets became available, KEF, in 1988, was the first to place a really small dome tweeter at the top of the woofer magnet pole piece, starting a new era of cost-effective coaxial drivers. BMS has designed interesting 2- and 3-way coaxial compression drivers, Cabasse has generated several constructions extending from 2-way to 4-way direct radiators and Pioneer has refined the diaphragm materials; these are just a few companies who have been active in this specific driver technology area.

Although conventional coaxial designs provide several key advantages, they also present drawbacks. The woofer cone movement causes intermodulation and Doppler distortion to the tweeter radiation. The larger the cone displacement the more intermodulation will be produced. The directivity, although improved at crossover, may not be uniform at higher frequencies. Also, most current common tweeter-midrange driver constructions have inherent acoustic discontinuities, which show up as an uneven on-axis HF response. Whether these are judged to be important depends totally on the application and the degree of desired perfection. As history shows, the benefits have exceeded the drawbacks.

The common challenge in all coaxial designs is how to avoid the aforementioned acoustical discontinuities and their effects on the response. Diaphragms have to move, there have to be gaps, but sound is easily diffracted from such discontinuities and so on. The following picture shows the typical situation with a somewhat uneven response.

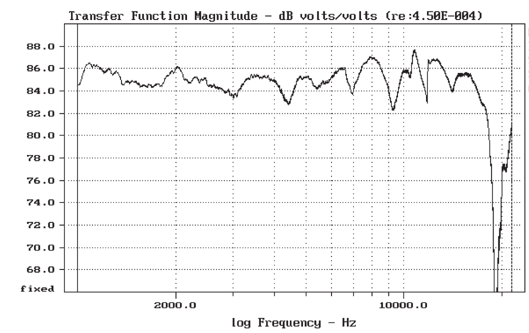

Figure 1: Frequency response of a typical coaxial driver. Frequency response from 1kHz to 20kHz.

THE GENELEC MDC — The first step was to minimise the cone displacement; in other words to limit the low frequency bandwidth of the driver. This is both trivial and simultaneously important for the accepted solutions. Avoiding the sources of diffraction was more complicated. The solution resulted in several ideas, some of which are now included in the MDC driver.

The main structure of the MDC design consists of an integrated MF diaphragm-suspension-tweeter construction. The visible part of the coaxial driver is formed by the curved flexible skin with the dome tweeter assembly at its centre. The inner section joins the cone to the tweeter without any acoustical discontinuity, and the outer one does the same between the cone and the driver chassis. As there are no acoustically observable discontinuities between the tweeter and the cone, just a smooth surface, there is no diffraction either. The cone profile is very carefully optimised to form an integrated directivity control waveguide for the tweeter radiation. The driver outer edge is terminated to a normal Genelec DCW to control the dispersion of midrange radiation as well.

The system looks surprisingly simple and tidy and this development in coaxial design improves imaging and overall sound quality. The response is very smooth both on and off-axis and free from any anomalies and directivity is well controlled.

Besides providing more sound pressure than the 8000 series 2-ways, the 8260A combines, for the first time, a coaxial driver (MDC) within a modern waveguide (DCW), ensuring drivers couple coherently over their full operating bandwidth as well as being a single MF/HF coincident point source.

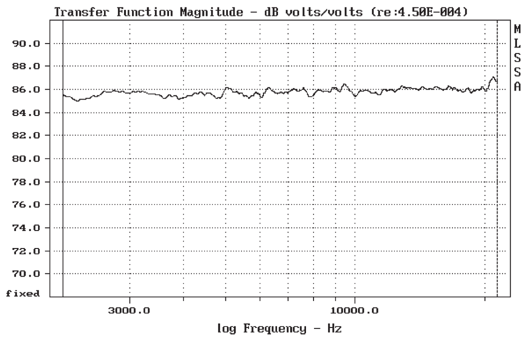

Figure 2: On-axis frequency response of the Genelec MDC driver. Frequency response from 2kHz to 20kHz.

Following current Genelec practice the 8260A uses a die-cast aluminium enclosure that is beneficial in many aspects. First, for given external dimensions the internal effective volume can be increased, which improves low frequency efficiency and provides extended LF cut-off. In the case of the 8260A the cut-off is 26Hz (-3dB). The curved surfaces are inherently rigid and their structure resonances are at higher frequencies and thus easily damped. Any heat generated in the power amplifiers and the drivers is effectively conducted away, which improves system reliability. Resilient to handling and wear, die-cast aluminium allows easy integration of supports and mounting options in the enclosure. Finally, aluminium is recyclable.

The Genelec IsoPod vibration isolation stand is a part of the 8260A as well. The IsoPod stops the propagation of whole enclosure vibration to the surrounding structures. It also allows vertical tilting of the system so it can be aimed at a listening position.

DSP IN 8260A — The DSP hardware is a true three-way, in which the driver feed signals for the tweeter, midrange and woofer are all fed into their own D-A convertors, then to three power amplifiers, and then finally onto each drive unit.

The DSP processor in the 8260A contains all basic loudspeaker functions, such as the crossover filters, driver equalisation, driver position alignment, as well as the room alignment related filters (room response equalisers and propagation delay correction). The mechano-acoustical design produces constant directivity characteristics and combined with digital signal processing this results in a loudspeaker that is capable of outstanding performance in very different and challenging acoustic conditions.

The 8260A has six configurable notch filters, and two high- and two low-frequency shelving filters for room alignment and calibration. The adjustment ranges of the notch filters are wide and flexible allowing broad response alignments as well as careful correction of room mode problems. The parametric notches and shelving filters can be set automatically using the AutoCal automatic room alignment process built in the GLM software. (See figure 3).

The GLM software handles the 8260A like any other Genelec DSP loudspeaker in a system and it is possible to mix the 8260A and 8200 series two-way loudspeakers in the same system. AutoCal is the automated room calibration and sound system alignment method. It provides consistent and accurate frequency response for a multichannel audio system in widely varying room environments.

Assuming typical application areas, the three-way 8260A has an extended set of room response controls and can thus be adjusted to acoustically more complex spaces. The system alignments provided by AutoCal include frequency response calibration for each loudspeaker, based on either a single microphone position (SinglePoint), or an average of up to four microphone positions (MultiPoint), delay and sound level calibration at the primary listening position, as well as subwoofer-main loudspeaker crossover optimisation.

GLM also features AutoLink, an additional proprietary software allowing the user to automate GLM start-up and set certain functions into computer keyboard keys for easy access and operation, even without having the GLM software user interface visible. An example of this is to tie system setup files to certain keyboard keys. Pressing the key will automatically open and load the system setup. This can be used, for example, to optimise monitoring for several individual seats in the room, such as the primary monitoring position and the producer's position, or to move quickly between the main monitoring system and the smaller nearfield monitoring system.

The 8260A loudspeaker represents Genelec's cutting-edge innovation in all technology domains. The cornerstone of the enclosure design draws on the advantages of the 8000 series. In addition, the electronic domain (hardware and software) of the system benefits from the 8200 Series design with the advanced AutoCal calibration system. The MDC coaxial MF/HF is a breakthrough and makes the loudspeaker unique in the market. Such breakthroughs are the results of long-term persistent and solution-oriented research and development work. ■

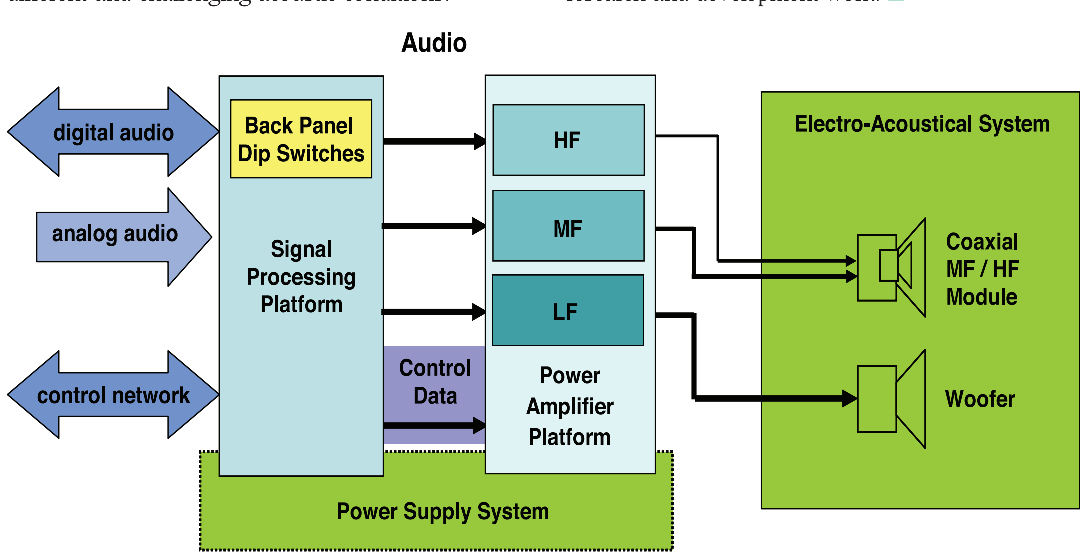

Figure 3: Main building blocks of Genelec 8260A loudspeaker.