Amigo FM Signal Processing

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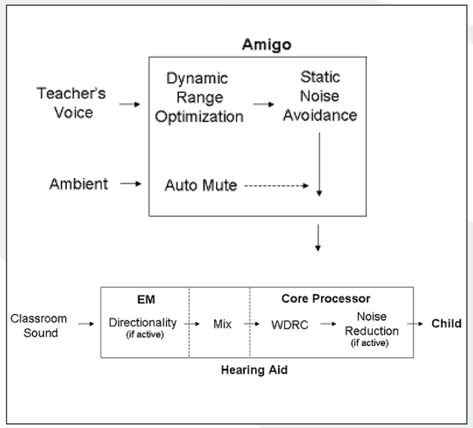
Digital signal processing sets Amigo apart from other commercially available FM systems. Oticon has implemented proprietary digital signal processing to specifically enhance and manage the Amigo FM system. This overview reveals how digital signal processing in the Amigo FM system is similar to hearing aid processing, yet is uniquely configured to be more appropriate for FM application.



- The audiologist adjusts the hearing aid (not the FM system) to appropriately control gain, compression and the use of directionality and/or noise reduction.

- The Amigo FM system presents to the hearing aid a clean, linear, FM signal within the middle of the operating range of the hearing aid's input/output function. When using the combined FM and environmental microphone (EM) option, the FM signal is delivered at an amplitude level significantly higher than the environmental microphone (if used) to maintain an advantageous signal-to-noise (SNR) ratio.
- Non-linear aspects of Amigo are inactive when the teacher is speaking at an appropriate loudness in a reasonably quiet classroom. However, additional signal processing within the Amigo is automatically initiated when the teacher's voice is too soft, and/or when the background noise deleteriously impacts the SNR.
- Amigo's **Dynamic Range Optimization** system adjusts the long-term loudness level of the teacher's voice to approximately 74 dB SPL. This single-channel compression system uses a maximum compression ratio of 1.4 to 1 and a long release time to maintain moment-to-moment (i.e., phoneme-to-phoneme) loudness relationships across speech sounds. Therefore, linear speech signals are transmitted from the Amigo to the hearing aid, allowing and maintaining natural amplitude relationships across all speech sounds.
- Amigo's **Static Noise Avoidance** system minimises annoying "static" noises such as heating and ventilation systems, air conditioners, computer fans, fluorescent lights and other relatively constant background noises. The Static Noise Avoidance system addresses two specific questions:

1 **Is speech present?**
2 **Are high noise levels present?**

- The Static Noise Avoidance system reduces gain when presented with a noise-dominated signal and/or a poor SNR. However, the Static Noise Avoidance system is significantly less aggressive when speech is present. For example, when a teacher is speaking in a quiet classroom, the Static Noise Avoidance system has no impact, as there is no need for the system to be engaged. Nonetheless, in a noisy classroom in which the teacher is not actively teaching (such as during breaks or playtime), the Static Noise Avoidance system engages to reduce the overall loudness. The Static Noise Avoidance system targets long-term, static sounds to decrease annoyance of unwanted sounds within the classroom.
- Amigo's **Auto-mute** system minimises "floor level" sounds when the system does not detect meaningful sound. For example, when the overall sound level drops below 35 dB SPL, an aggressive expansion system reduces the gain applied to very soft, room or system noises. Nonetheless, as soon as the signal increases to 35 dB SPL, the system instantly reactivates.
- The goal of the Amigo system is to present a long-term, clean, linear signal, at an appropriate intensity level, to the hearing aid. In comparison, the hearing aid's goal is to quickly react and manage the moment-by-moment changes in the signal and to deliver a maximally useful signal to the child's auditory system. Amigo's Dynamic Range Optimisation and Static Noise Avoidance systems compliment the hearing aid's noise management and compression systems. Dynamic Range Optimisation and Static Noise Avoidance systems engage more slowly and less aggressively than hearing aid sub-systems. ■

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