

Directional Options™

Understanding speech in background noise is a primary problem for individuals with hearing losses. While hearing instruments can provide increased audibility, difficulties with background noises often persist. The best way to improve speech understanding in background noise is to increase the signal-to-noise ratio (SNR). Increases in SNR can be achieved through the use of directional microphones. Commonly used directional microphone systems assume the desired signal is located in front of the listener, or in what is considered the “look direction.” Sounds originating from other directions are often considered noise, and the amplification for these signals is decreased.

Although directional microphones provide a more favourable SNR in noisy environments, many users experience diminished audibility for sounds of interest that do not arise from the “look direction.” As sounds from the sides and the back are reduced in amplification, users may report a feeling analogous to tunnel vision. That is, they may have a sensation of being cut off from much of their surroundings, resulting in a skewed perception of the listening environment as a whole.

To address this problem, the Danalogic i-FIT™ family features directional options which have been engineered to promote a more realistic experience.

Danalogic i-FIT Directional Processor™

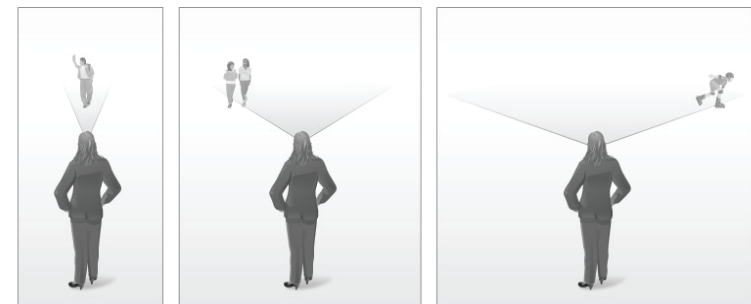
Danalogic i-FIT Directional Processor™ processes the directional signal based on the signal's frequency content. High-frequency sounds are processed as a directional response, while low-frequency sounds are assigned an omnidirectional response. This preservation of low-frequency sounds allows the user to take advantage of natural between-ear phase differences. The overall result is that listeners can better understand sounds from the front while maintaining a more natural sound quality and localization ability for sounds from all directions. The differentiation in processing between high- and low-frequency sounds is personalized based on the individual's hearing thresholds, hearing instrument style, and unique listening situations. The Directional Blend pull-down menu in the Aventa software allows for manipulation of the amount of high frequency directional signal applied. Directional Blend settings are Very Low, Low, Medium, and High, with a higher setting indicating more directional signal processing is provided.

Option 1: Fixed Directionality

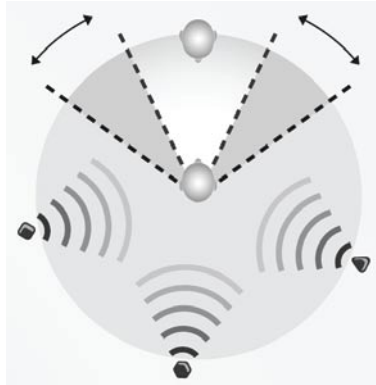
The fixed directional mode has a static, unchanging hyper-cardioid directional response pattern. In this mode, the environmental input is amplified more for sounds from the front than for sounds from the sides and back. Individuals who prefer more traditional directional processing patterns, such as in their previous hearing aids, may benefit from this setting.

Option 2: Intelligent Directionality with AutoFocus™

This provides various directional characteristics that adapt based on the intensity and direction of the noise. The microphones determine whether omni-directional or directional processing is advantageous, based on the sound inputs they receive. If the SNR is high (8 dB or greater), the omni-directional response is selected. If the SNR is lower than 8 dB, a directional response is chosen. The directional response offers no amplification to not only the strongest noise source behind the user, but also multiple noise sources in different spatial locations simultaneously when the frequency contents of the noise sources differ. Three beam settings of Narrow, Medium and Wide correspond to listening scopes of +/- 50, 70, and 90 degrees, respectively.



Danalogic i-FIT™ also introduces the option of AutoFocus™, which automatically adjusts the directional beam width based on the relative levels of inputs to the front and rear microphones. As the signal to the front microphone becomes more intense, the scope narrows. Alternately, as the signal to the front microphone becomes less intense, the scope widens, allowing more audibility for surrounding sounds. This creates an effect of zooming in on the speaker if he or she is directly in front of the listener, and zooming out when the listener is surrounded by other speakers.



Option 3: SoftSwitching Intelligent Directionality

SoftSwitching also uses knowledge about directional preferences along with acoustic analysis of the listening environment to control whether the hearing aid processes in an omni-directional or directional mode. Like Intelligent Directionality, SoftSwitching uses a sound level and a speech detection algorithm to decide when directionality is likely to be advantageous in a certain listening environment. The SoftSwitching mode differs in that it uses slower transitions between directional settings and the omni-directional setting, which is sometimes preferable among hearing aid users.

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Discussion

Danalogic i-FIT™ provides improved directionality options to meet the individual needs of the listener. This degree of flexibility allows for a personalised fitting experience for a wide variety of listening situations.

References

Bentler RA, Egge JLM, Tubbs JL, Dittberner AB, & Flamme GA. (2004). Quantification of directional benefit across different polar response patterns. *Journal of the American Academy of Audiology*, 15, 649-659.

Cord MT, Walden BE, Surr RK, & Dittberner AB. (2007). Field evaluation of an asymmetric directional microphone fitting. *Journal of the American Academy of Audiology*, 18, 245-256.