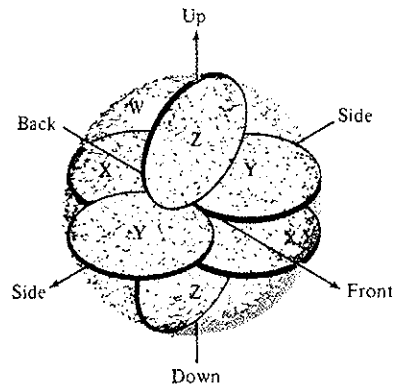


NIGEL BRANWELL

# The Calrec Soundfield Microphone System

The Soundfield capsule array provides four supercardioid outputs (the A-format signals) and these are used to derive the B-format signals, W, X, Y, & Z. These represent:  
W—Omni-directional pattern,  
X—Bi-directional pattern (front-to-back),  
Y—Bi-directional pattern (side-to-side),  
Z—Bi-directional pattern (up-and-down).



THE CALREC CM 4050 Soundfield Microphone consists of four hypercardioid capacitor capsules arranged in a regular tetrahedron so as to detect the soundfield at the surface of the sphere. The signals derived from the four capsules are known as A Format signals.

The capsules are mounted as close together as possible while subsequent electronics located in the A/B matrix module of the control unit produce truly coincident signals up to 11 kHz with limited divergence above this frequency.

A 12-wire single-screened cable is used to connect the microphone to the input module of the control unit. The input module has a switchable 10 dB attenuator for use in very high sound levels while four capsule mute buttons allow capsule checking.

Within the A/B Matrix Module, various combinations of the A Format signals are used to produce the four B Format outputs which are available to the user for recording and/or further processing. The B Format outputs are shown in FIGURE 1.

The B Gain Module follows: this is a four-gang level control of the B format signals, both to the main set of B Format outputs and to the subsequent modules.

The B Monitor Module receives the B Format signals from the B Gain Module and feeds them without active circuitry to the Tape Record Outputs. A Test pushbutton substitutes a line-up tone. The B Format signals are also passed to the subsequent Control Unit Modules, except when the Tape button is pressed.

In this case, B Format signals are recorded directly on tape. Later on, these B Format replay signals are passed on to the subsequent modules for Post-Session processing.

## B-FORMAT PROCESSING

The Soundfield 1 Module allows the Azimuth and Elevation controls to process direct or taped signals.

The Soundfield 2 Module allows the appropriate Dominance to be chosen via the Up/Down or Front/Back switches. The dominance control modifies the effective directions or arrival of sounds and also their loudness. Compensation is provided such that the ratio of the energy in the velocity of the signals to the energy in the pressure signal remains unchanged, although a use of the control is to emphasize a particular direction and/or to de-emphasize others so that an apparent change in program level is usually heard.

The Mono/Stereo/Quadruple Module selects the microphone type to be synthesized from the B Format signal in Stereo/Mono and into Quadruple. The angle between the synthesized stereo pair or quad pair can be varied from zero (pointing in the same direction) to 180 degrees (back-to-back).

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The Polar Pattern can be varied from omni-directional to figure-eight and all intermediate cardioid positions.

The Output Module contains a Level Control, Output Selector, and Loudspeaker Layout Control for the Ambisonic Decode Positions and fields the X (LB), W (LF), Y (RF) and Z (RB) output sockets.

In the Stereo/Mono mode, the LF and RF outputs are only used for "double" Mono or Stereo, both with Azimuth, Elevation, Pattern and Angle control facilities available. In the Quadruple, four cardioid microphones are synthesized for LB, LF, RF, and RB.

The Ambisonic Decode processes B Format signals from the microphone or Tape Replay inputs to produce loudspeaker feeds for horizontal surround sound—azimuth, elevation, dominance are operative, but capsule angle and pattern are inoperative. The decoder has shelving filters to optimize psycho-acoustic performance, and is designed for four loudspeakers two to three meters from the listening position in a rectangular layout.

The LS Layout control varies the signal to suit rectangular layouts of various aspect ratios. In the B Format mode, a full B Format output is available with the extra facilities of Azimuth, Elevation, and Dominance. This B Format output can be used in dubbing already-recorded B Format material where modification is needed, or while recording if it is felt necessary to use the Azimuth, Elevation and Dominance controls in this condition. The Level knob controls all four output signals in all modes and tracks accurately over a 30 dB range.

In summary, the Soundfield Microphone consisting of four capsules in a tetrahedral array with electronic compensation to remove the effects of capsule spacing, is designed to accurately capture the sounds that exist at a point in space. It may be used for mono and stereo as well as surround sound; its directional characteristics can be steered electronically from a remote location. By storing the Soundfield Microphone's signals in B Format, optimum recordings may be issued not only in Mono and Stereo, but in Surround sound, or later, even Peripherically (with height).

A fuller discussion of Ambisonic Recording and Reproduction will follow at a later date, but suffice it to say here that its supporters feel the process is far superior to discrete Quadraphony. It is hoped that Ambisonics will be of particular interest for the new media of digital discs and digital satellite broadcasting. These new media are able to handle four periphonic signals of full audio bandwidths. In the case of AM/FM broadcasting, a 3-channel Ambisonic (surround sound) signal can be transmitted with the additional third channel carried in a stereo multiplex signal by an additional modulation of the sub-carrier. Whether reproduced in Mono, Stereo, 3-Channel, or even 4-Channels, all are compatible.