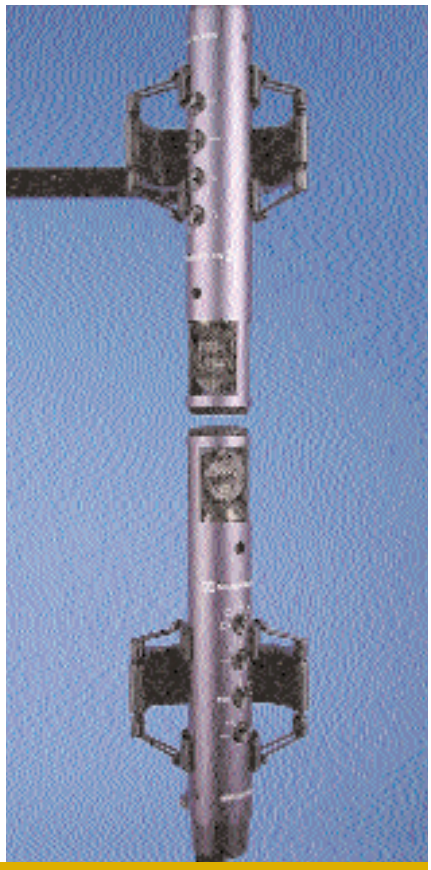
Stereo and Surround Miking Techniques (I)

"Spatial recording technology reproduces the sound field of the recording space in the space in which it is played back" – a brief, concise sentence from a textbook. This statement has been the cause of much research, teaching, frustration, and sometimes pleasure since the invention of sound recording. Ideally, the reproduction of the sound field can be best achieved with as many recording and playback channels as possible. As a rule, however, it has usually been done using only two channels, largely for reasons of cost and compatibility.

Unfortunately, the quadraphonic system, which emerged in the 1970s, quickly disappeared without a trace, and no one suspected that such a format would be given a new lease of life. New digital algorithms and data reduction schemes in audio technology have recently made it possible to once again bring sophisticated home theater sound into the living room. In addition to movie scores and effects, pure classic listening pleasure is now also possible with more channels. Thus, the job of the producer is to offer as much as possible with the least possible effort.



XY stereo

Stereo microphone configurations

Several microphone configurations, each with different effects, can be used to obtain a two-channel stereo sound image. In these configurations, we distinguish between intensity stereo, in which the stereo effect is achieved primarily by differences in level between the left and right signal, and time delay stereo, in which the effect is achieved by differing time delays of signals to the recording microphones. It is important to consider mono compatibility, especially when it comes to television sound, as many sets still only have mono sound.

XY Stereo

The most well-known and reliable method to achieve stereo sound is to arrange the microphones in the so-called 'XY' configuration. Two microphone systems with the same pick-up pattern (for example, cardioid MKH 40s) are placed directly one above the other, and arranged at some angle. The stereo width of the sound image is determined only by the included angle. The advantage of this arrangement is that it provides pure intensity stereo that is always mono-compatible. There are no time delay differences that might otherwise lead to phase-dependent signal cancellations when the two channels are connected together.

MS Stereo

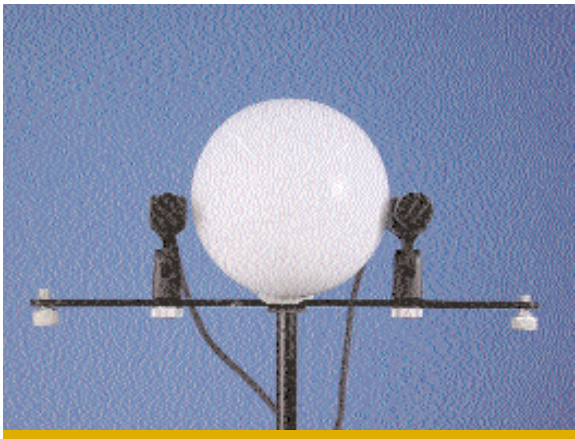
The MS (middle/side) stereo technique also involves two microphones placed directly one above the other. In this case, the 'S' system always has a figure-of-eight pick-up pattern (MKH 30) and is placed at an angle of 90° to the sound source. The other system (M) can have an omni-directional (MKH 20), cardioid (MKH 40) or super-cardioid (MKH 50) pick-up pattern and is always directed toward the center of the sound source with an angle of 0°. This arrangement does not directly deliver the signals of the right and left channel but instead, the stereo signal must be obtained by calculating the sum and difference of the M and S signals. This takes place in a matrix, which, in the simplest case, consists of two transformers. The MS configuration is the method most frequently used for television sound, where if needed, the 'M' signal can be used as the ideal mono signal. Moreover, this technique allows the possibility of influencing the stereo width and the direction of the sound during editing.

AB Stereo

AB stereo, otherwise known as "spaced pair", is a method frequently used in the music industry for classical music recordings. Two microphones, usually with an omni-directional pick-up pattern (MKH 20), are placed in front of the sound source at 20 to 100 cm apart. In this arrangement, the diffuse sound field, which contributes to the spatial impression, is the carrier of the directional information. Due to the time delay differences, a very good spatial image is achieved. However, this configuration is, strictly speaking, not mono-compatible.

Dummy Head Stereo

Dummy head or "binaural" stereo makes use of time delay, but it also uses the differences in sound level caused by the 'separator body', most often a replica or "dummy" human head. In essence, this is an AB technique with a 'separator body' which simulates the listener's head.



Dummy head or binaural stereo

Stereo and Surround Microphone Techniques (III)

The third and last part of our series is all about surround sound.

Dolby Surround This is the simplest type of surround sound recording. The rear image needs a mono signal that is divided between the L and R channels with identical amplitude but out of polarity from each other. An XY configuration (without time delay) is needed for the recording, together with an additional channel, which is split and mixed out of polarity with the existing LR channels. This is generally done by a so-called ProLogic encoder, with which it is also possible to set time delays (5 to 15 ms) between the rear and the front signal, in order to improve the perceived directionality of the sound.

Guidelines for Productions in Dolby Surround

1. Dialog always comes from the center (volume reduced by 3 dB).
2. Stereo music and movements (cars, doors, windows, shots) are reproduced either by the right-hand or left-hand loudspeaker.
3. Atmospheric sounds, such as rain, wind and murmuring, are reproduced by the surround loudspeakers with band limiting and a level reduction of 3 dB.

The basic functions of a Dolby surround encoder can be defined as follows:

1. Signals in the left and right channels with the same amplitude and polarity are reproduced through the center channel.
2. Signals in the left and right channels with the same amplitude, but which are out of polarity, are reproduced through the surround channel.
3. Signals in the center and surround channels with the same amplitude and polarity are reproduced through all channels at almost the same volume.
4. Signals in the left (right) and surround channels with the same amplitude and polarity are reproduced through the right (left) and center channel with a reduction of 12 dB.
5. The separation of the individual channels must be greater than 30 dB across the entire frequency range of 100 Hz to 20 kHz.
6. In mono reproduction, the surround signals must be erased; in stereo reproduction, their level must be reduced.

On the basis of this definition, Figure 1 shows a live recording made without a special encoder, which can be reproduced using a Dolby decoder. This is achieved with a special microphone configuration that uses only the acoustics and the level controller and panpots of a mixing console. Three microphones with suitable characteristics are set up in a configuration that corresponds to a large extent to the definition above. This means that the recording does not need to be processed with an encoder.

MPEG II (5:1) This format and its related technology allow the imagination and creativity of artists free rein. With MPEG II you have five real channels with full bandwidth at your fingertips and you are not constrained by the strict Dolby rules. However, the laws of physics and psychoacoustics still come into play.
For the recording, you arrange two stereo microphones one above the other. **The usual color coding is: front left = yellow, front right = red, rear left = green, rear right = blue. The tracks on the recorder should be allocated as follows: 1=L, 2=R, 3=C, 4=RL, 5=RR.** The center microphone is either a separate microphone or a central signal generated by a matrix from the R+L data. The sound is reproduced through loudspeakers distributed around the room.

Günther Theile from the German Institute for Radio Technology suggests the use of a cross shape configuration similar to a double ORTF setup, as the intensity and time delay characteristics of such a system are ideal for a realistic acoustic image (see Figure 2). The major advantage of this configuration is that it is always backwards compatible. It can be used to create mono, stereo and Dolby surround recordings. However, despite its versatility, MPEG II has one small but crucial problem. The staggered data reduction process, which is divided into a number of layers, often results in undesirable fading, particularly in the reproduction of echoes and atmosphere. This is caused by the ''joint stereo'' setting (see Figure 3). The reduction algorithm is changed again, in this case by reducing the number of positions. In the figure there are 7 positions that can be reproduced most consistently if only intensity stereo is used. In the case of time delay stereo, resonances may occur in the room.