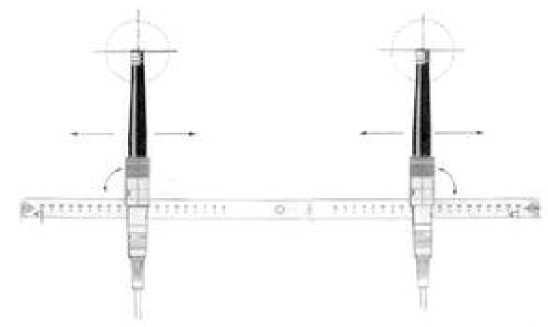
http://www.dpamicrophones.com

Pro Audio Dictionary

A-B stereo

Two spaced omni directional microphones creating a stereo image.

The A-B Stereo Technique - or Time Difference Stereo, as it is sometimes called - uses two spaced omni directional microphones to record audio signals. The microphone spacing introduces small differences in the time or phase information contained in the audio signals (according to the relative directions of the sound sources). As the human ear can sense time and phase differences in the audio signals and use them for localisation, time and phase differences will act as stereo cues to enable the listener to "capture the space" in the recording, and experience a vivid stereo image of the complete sound-field, including the positioning of each separate sound-source and the spatial boundaries of the room itself.



Microphone spacing

An important consideration when setting up for A-B stereo recordings is the distance between the two microphones. Since the acoustic character of the stereo recording is very much a question of taste, it is impossible to give fast rules for stereo microphone spacing, although it is a good idea to keep some important acoustic factors in mind.

Since the stereo width of a recording is frequency-dependent, the deeper the tonal qualities you wish to reproduce in stereo, the wider your microphone spacing should be. Using a recommended microphone spacing of a quarter of the wavelength of the deepest tone, and taking into account the human ear's reduced ability to localise frequencies below 150Hz, leads to an optimal microphone spacing of between 40 and 60 cm. Smaller microphone spacing's are often used close to sound-sources to prevent the sound image of a particular musical instrument from becoming "too wide" and unnatural. Spacing's down to 17 to 20 cm are detectable by the human ear, as this distance is equivalent to the distance between the two ears themselves.

It should also be noted, that an increase in microphone spacing will decrease the system's ability to reproduce the signals from sound-sources positioned directly between the microphones. This will also lead to a reduction in the quality of the stereo recording when it is played in mono.

Distance between microphones and sound-source.

The ideal distance from the microphone pair to the sound-source not only depends on the type and size of the sound-source and on the surroundings in which the recording is to be made, but also on individual taste. The position from which the listener experiences the event - and hence the position from which the microphones record the event - should be chosen with care and feeling.

Critical musical recordings, such as a full orchestra in a concert hall, are good examples of the importance of correct stereo microphone positioning. Here the microphones would typically be placed above or behind the conductor. Although most instruments project their sound in an upwards direction, the microphones should be placed high enough so that the individual musicians do not shadow each other.

The mix of direct and diffuse sound in a recording is also of crucial importance, so, much time can often be used establishing the optimum positioning of the microphones. It is here that the versatility of our A-B Stereo Kits comes into play. Using the different acoustical attachments for the microphones, the amount of ambience and the tonal colour of the recording can be adjusted without adding any noise. The choice of floor and ceiling mounting of the boom can give you added flexibility when positioning the microphones.

Omni directional microphones and A-B Stereo are often the preferred choice when the distance between microphone and the sound source is large. The reason is that omni directional microphones are able to capture the true low frequencies of the sound-source regardless of the distance, while directional microphones are influenced by the proximity effect. Directional microphones will therefore exhibit loss of low frequencies at larger distances.

A-Weighting

Electronic network designed to accentuate or attenuate signal levels at certain frequencies in order that the system response corresponds to the results of subjective tests of the ear's sensitivity. The A-weighting curve corresponds to the inverse equal loudness contour at a level of 40 phons.

Absorption

The conversion of sound energy into another form of energy, usually heat, when passing through an acoustical medium.

Absorption Coefficient

Ratio of sound absorbing effectiveness, at a specific frequency, of a unit of acoustical absorbent to a unit area of perfectly absorptive material.

Ambience

The characteristic of a location which is said to be representative of the particular room, concert hall etc.

Ambience Miking

See "Remote Miking"

Ambient Noise

The noise level associated with a location in the absence of foreign excitation.

Anechoic Chamber

A room where the walls effectively absorb all incident sound, thereby creating a free-field condition for measurement purposes. A room in which there is little reverberant sound is said to be a "dead room".

Audibility Threshold

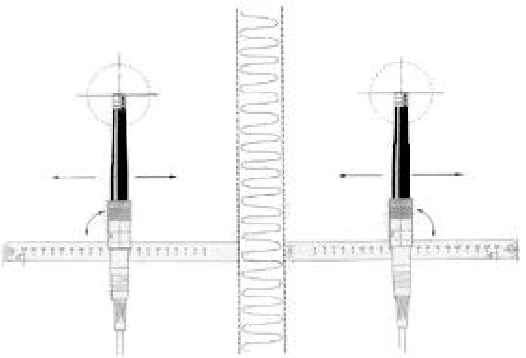
The sound pressure level, for a specified frequency, at which persons with normal hearing begin to respond.

Baffled stereo

Spaced microphone stereo techniques using an acoustic absorbent baffle.

Baffled stereo is a generic term for a lot of different stereo techniques using an acoustic baffle to enhance the channel separation of the stereo signals. When placed between the two microphones in a spaced stereo set-up like A-B stereo, ORTF stereo, DIN stereo or NOS stereo, the shadow effect from the baffle will have a positive influence on the attenuation of off-axis sound sources and thereby enhancing the channel separation. Baffles should be made from an acoustic absorbent and non-reflective material to prevent any reflections on the surface of the baffle to cause colouring of the audio.

One of the more well known baffled stereo principles is the so called Jecklin Disc developed by the Swiss sound engineer Jürg Jecklin. This techniques uses two Type 4003 or 4006 omni directional microphones spaced 36 cm and a special acoustic treated disc with a diameter of Ø35 cm placed between the microphones.



At present there is not an acoustic baffle available from DPA Microphones.

Binaural stereo

Two omni directional microphones placed in the ears of a dummy head creating the stereo image.

The Binaural recording technique uses two omni directional microphones placed in the ears of a dummy head and torso. This two-channel system emulates the human perception of sound, and will provide the recording with important aural information about the distance and the direction of the sound-sources. When replayed on headphones, the listener will experience a spherical sound image, where all the sound-sources are reproduced with correct spherical direction.

Binaural recordings are often used as ambience sound or in virtual reality applications.

Blumlein stereo

Two bi-directional microphones placed in the same point and angled 90° creating the stereo image.

The Blumlein stereo set-up is a coincidence stereo technique, which uses two bi-directional microphones in the same point and angled at 90° to each other. This stereo technique will normally give the best results when used at shorter distances to the sound source, as bi-directional microphones are using the pressure gradient transducer technology and therefore is under influence of the proximity effect. At larger distances these microphones therefore will loose the low frequencies. The Blumlein stereo is purely producing intensity related stereo information. It has a higher channel separation than the XY stereo, but has the disadvantage, that sound sources located behind the stereo pair also will be picked up and even be reproduced with inverted phase.

Boundary layer microphones

Microphones placed directly on the surface of a large boundary - also called Pressure Zone Microphones or PZM microphones.

Please see PZM microphones under related articles.

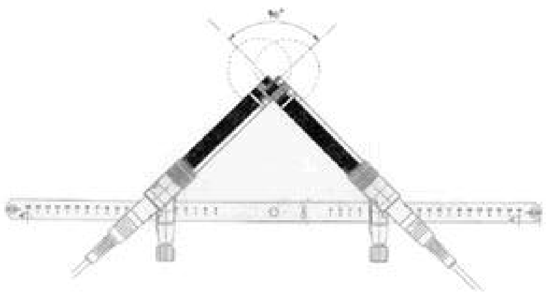
Close-miking

Placement of a microphone near a sound source, thus effectively eliminating all but the direct sound from the source.

Coincidence stereo

Stereo techniques where the microphone capsules are placed in the same point.

Coincidence stereo is the generic term for all stereo techniques where the two microphones are placed exactly in the same point. This technique uses directional microphones to create the stereo image. The stereo width is set by the microphones' off-axis attenuation and is both dependent on the stereo set-up and the quality of the individual microphone's polar pattern. Among the more well known coincidence stereo techniques are XY stereo, MS-stereo and Blumlein stereo.



Mono compatibility and dialogue

Normally coincidence stereo is characterised by a good mono compatibility, which is preferable if used on dialogue. Care should be taken when choosing microphone types for the stereo set-up, as the main dialogue should be placed in the centre, which in many cases (XY stereo and Blumlein stereo) is off-axis of the microphones. It is therefore important to check the off-axis characteristics of the microphones beforehand.

Coincident Microphone

Two or more microphones mounted on a common vertical axis.

Colouration

Non-uniformity in off-axis frequency responses resulting in a distortion of the tonal quality of the source.

Crosstalk

Measure of the separation in adjacent channels of a system expressed in -dB's. Equivalent to channel separation expressed in +dB's.

Damping

Removal of echoes and reverberation by the use of sound absorbing materials.

Decibel Scale

A linear numbering scale used to define a logarithmic amplitude scale, thereby compressing a wide range of amplitude values to a small set of numbers. A value X when expressed in dB is in relation to a reference value Xref: X (dB) = 20 Log10 X/Xref

Difference Frequency Distortion

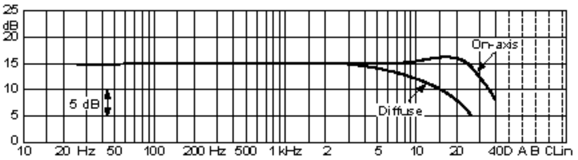
Difference frequency distortion considers only the difference terms of intermodulation distortion. Such tones are not harmonically related and are therefore musically undesirable. It is a percentage of the signal amplitude.

Diffuse Field

An environment in which the sound pressure level is the same everywhere and the flow of energy is equally probable in all directions.

Diffuse Field Response

The diffuse field response is significantly different from the on-axis response and shows the microphone's tonal qualities when placed in a highly reverberant environment with a large distance to the sound sources. This response is obtained by placing the microphone in an environment, where the sound pressure level is the same everywhere and the flow of energy is equally probable in all directions - a reverberant room. The diffuse field response normally shows a significant high frequency roll off compared to the on-axis response.



On-axis and diffuse-field responses of Types 4003/06/51/52/53 and 3529/30 with the standard protection grid DD0251 fitted.

Diffuse Sound

Sound that is completely random in phase; sound which appears to have no single source or direction.

DIN Stereo

Two first order cardioid microphones spaced 20 cm and angled 90° creating the stereo image.

DIN stereo uses two cardioid microphones spaced 20 cm apart and angled at 90° to create a stereo image. The DIN stereo produces a blend of intensity stereo signals and time delay stereo signals, due to the off-axis attenuation of the cardioid microphones together with the 20 cm spacing. If used at larger distances to the sound source the DIN stereo technique will loose the low frequencies due to the use of pressure gradient microphones and the influence of the proximity on these type of microphones. The DIN stereo technique is more useful at shorter distances, for example on piano, small ensembles or used for creating stereo on a instrument section in a classical orchestra.

Direct Sound

The sound that arrives at the reception point directly (no reflections). Sound lacking in any reverberation.

Directional Characteristic

Measure of the response of a microphone to sound incident from various angles, or of the radiation pattern of a loudspeaker. The sensitivity (referred to on-axis sensitivity) is plotted as a function of angle of incidence at various frequencies. Also called "polar pattern".

Dry Miking

See "Close Miking"

Dynamic Range

Range between the quietest and loudest levels a device can produce or detect. For a microphone or measuring system it is normally specified as the range between the inherent noise level and a level leading to a specified amount of distortion.

Echo

One or several distinct repetitions of a sound. See "Reverberation"

Far Field

Distribution of acoustic energy at a very much greater distance from a source than the linear dimensions of the source itself.

Free Field

An environment in which there are no reflecting or obstructing boundaries and the sound field consists of uniformly progressing plane waves.

Frequency Range

The frequency range is also called the microphone "bandwidth". Unlike the frequency response it is not represented by a graph, but will give the sound engineer a rough indication of the microphone's tonal span and whether it will match the full span of the sound source. The frequency range states the microphone's upper and lower limiting frequencies plus the tolerance field of the on-axis response in dB. If no tolerance field is indicated the frequency range is submitted as the -3dB points of the on-axis response.

Frequency response

The frequency response of a microphone is the characteristic graph obtained by recording the level in dB of the output signal of the microphone, while the microphone is exposed to a certain acoustic field of pure sinusoidal tones with equal intensity. The frequency response gives important information about the tonal balance of the microphone under different acoustic conditions.

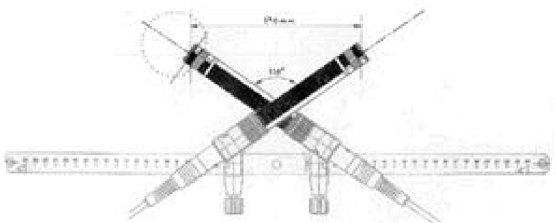
Handling Noise

The sensitivity of a microphone to movement and shock. Expressed as an equivalent sound pressure level.

Head related stereo

Stereo techniques using the human interaural geometry as a model for the microphone set-up.

Head related stereo is a generic term for a lot of different stereo techniques using both difference-in-time and difference-in-intensity stereo with microphone spacing and microphone off-axis attenuation related to the distance between the human ears and the shadow effect of the human head. Among the more standardised head related stereo techniques are ORTF stereo and DIN stereo.



Head related stereo should not be confused with binaural stereo where the human head is simulated through the use of a dummy head and torso.

Headroom

Difference between standard operating level of 0VU (+4dBm) and a specified distortion level.

Hertz

The unit of frequency measurement, representing cycles per second.

I.S.R.C.

International Standard Recording Code. Information about the country of origin, the owner, the year of recording and the serial number of a recording encoded on compact disc.

Inherent Noise

The noise which is internally generated in a system in the absence of any excitation. For a microphone, usually expressed as an equivalent sound pressure level which would produce the same output voltage as the noise voltage. Also called "self-noise".

Intermodulation Distortion

The interaction of two or more frequencies in a signal that results in the generation of new frequency components not present in the original signal. These new components have frequencies equal to the sum and difference of the frequencies of the original signals, and integral multiples thereof.

Isolation

Resistance to the transmission of sound by materials and structures.

Labels

An exciting feature of digital audio for producers, recording engineers etc. When directly recording multi-track music onto a digital medium, special bits are reserved for non-audio information called labels. The information contained in these bits can keep track of things like amount of microphones used for each take, their position, setting of the mixing console etc.

Loudness

Subjective impression of the intensity of a sound.

Lower Limiting Frequency (–3dB point)

The lower frequency at which the frequency response of a pressure microphone has fallen by 3dB. Determined by the venting system which equalises the static pressure difference between the inside and outside of the cartridge.

Masking

The process by which the threshold of audibility of one sound is raised by the presence of another (masking) sound.

MIDI

Musical Instrument Digital Interface. A standard that defines and recommends hardware and procedure for control and communication between a controller and one or more MIDI-equipped musical instruments.

MS-stereo

One first order cardioid microphone and one bi-directional microphone in the same point and angled 90° creating a stereo image through a so called MS-matrix.

MS-Stereo uses a cardioid microphone capsule as centre channel and a bi-directional microphone (figure-of-eight-microphone) at the same point, angled at 90° as the so-called surround channel. The MS-signal can not be monitored directly on a left-right system. The MS-matrix uses the phase cues between the centre and the surround microphone to produce a left-right signal suitable for a normal stereo system. Due to the presence of the centre microphone, this technique is well suited for stereo recordings where a good mono-compatibility is needed, and is extremely popular in broadcasting.

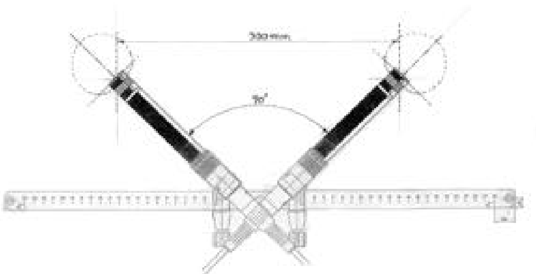
Near Field

That part of a sound filed, usually within about two wavelengths from a noise source, where there is no simple relationship between sound level and distance.

NOS stereo

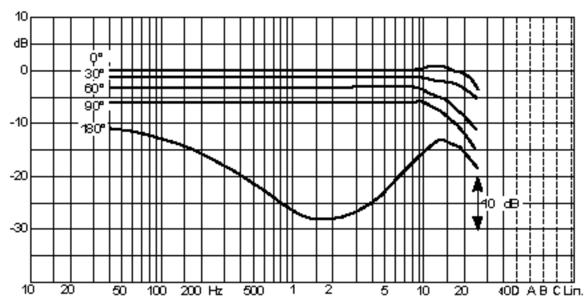
Two first order cardioid microphones spaced 30 cm and angled 90° creating the stereo image.

The NOS Stereo Technique uses two cardioid microphones spaced 30 cm apart and angled at 90° to create a stereo image, which means a combination of difference-in-level stereo and difference-in-time stereo. If used at larger distances to the sound source the NOS stereo technique will loose the low frequencies due to the use of pressure gradient microphones and the influence of the proximity on these type of microphones. The NOS stereo technique is more useful at shorter distances, for example on piano, small ensembles or used for creating stereo on a instrument section in a classical orchestra.



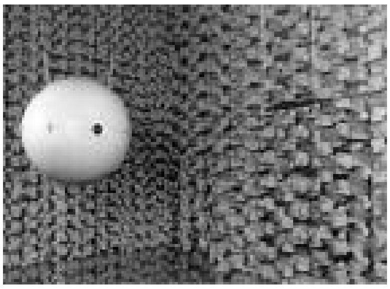
Off-axis response

Off-axis responses are normally submitted for directional microphones only. Linear off-axis qualities on directional microphones are extremely difficult to obtain. Therefore it is important to pass on information about the off-axis response to the sound engineer, so he can compare the acoustic quality of different microphone types. The off-axis response tells the sound engineer how the microphone will treat possible leakage from other sound sources with regards to both attenuation and frequency response. When measuring the off-axis response the microphone is placed in a "free sound field" consisting of plane waves similar to the conditions when measuring the on-axis response. The microphone is turned off-axis so that the incidence of the sound waves on the microphone diaphragm (or the microphone's reference direction) are in a certain direction. Normally manufacturers are using angles like 30°, 60°, 90° and 180° showing the off-axis response in the same diagram as the on-axis response.



On-Axis Response

The on-axis response is normally just referred to as the microphone's frequency response and will give information about the product's tonal behaviour when placed close to the sound source. It is normally obtained by placing the microphone in a "free sound field" consisting of plane waves frontally incident on the microphone diaphragm. Also called "axial free-field response" or "0 degrees incidence free-field response".

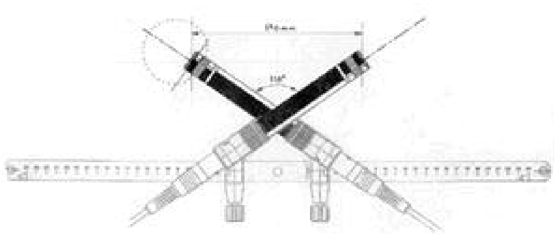


It is vital to the method that the free field conditions are obtained under reliable circumstances: Either in an anechoic room or by using measurement equipment with time frame frequency analyser possibilities.

ORTF stereo

Two first order cardioid microphones spaced 17 cm and angled 110° creating the stereo image.

The ORTF stereo technique uses two first order cardioid microphones with a spacing of 17 cm between the microphone diaphragms, and with an 110° angle between the capsules. This technique is well suited for reproducing stereo cues that are similar to those that are used by the human ear to perceive directional information in the horizontal plane. The spacing of the microphones emulates the distance between the human ears, and the angle between the two directional microphones emulates the shadow effect of the human head.



The ORTF stereo technique provides the recording with a wider stereo image than XY stereo and still preserves a reasonable amount of very good mono-information. Care must be taken not to use this technique at larger distances, as the directional microphones will result in low frequency loss in the recording.

Overhead microphones

Placing microphones above the sound source in order to pick up more ambience with the instrument.

Overhead microphones are often used on drums and percussion plus on small classical ensembles or on sections of classical orchestras in order to pick up the instruments with a blend of natural ambience. By placing the microphones above the musical instruments and at a slight distance, it is often possible to capture more of the instrument's natural timbre, because the sounds from all the different parts of the individual musical instrument will have time to reach the microphones with a more realistic dispersion, than in close miking situations. It is even possible to capture some of the first room reflections and thereby placing the instruments in their natural acoustic environment in the recording. Overhead microphone techniques covers both mono and stereo solutions and has no preference to the microphone's pick up pattern i.e. if the microphone is directional or omni directional.

The influence of the microphone's polar pattern:

The choice between directional or omni directional microphones in the overhead set-up is mainly a matter of taste. Naturally enough the use of omni directional microphones will add more ambience to the recording than the use of directional microphones will. Omni directional microphones are furthermore not under influence of the proximity effect like the directional microphones are and will not change their characteristics if moved closer or further away from the sound source.

Stereo on overheads:

A stereo overhead set-up is often chosen in situations where more sound sources are present at the same time; like on a drum kit, a large percussion set-up or a classical ensemble. The stereo set-up is then used to place the different sound sources correctly with regards to their direction from the listeners point of view. It is also possible to have a better coverage of all the different sound sources using a two-microphone-technique. If the overhead microphones need to be supported by close miking techniques, the stereo image form the overhead microphones can be used as a help to place the close up microphones correctly in the total stereo image.

P-Popping

Noise associated with the vocally-induced distortion in a microphone due to consonant sounding, "p", "b", "t" etc.

Pascal, Pa

A unit of pressure corresponding to a force of 1 Newton acting uniformly upon an area of 1 square metre. Hence 1 Pa = 1N/square metre.

Phantom Powering

A technique for supplying the preamplifier supply voltage to condenser microphones whereby half of the d.c. flows through each signal conductor and returns to the voltage source via the cable shield. Commonly 12V or 48V (DIN 45 596).

Phon

The loudness level of a sound. It is numerically equal to the sound pressure level of a 1kHz free progressive wave which is judged by reliable listeners to be as loud as the unknown sound.

Pink Noise

Broadband noise whose energy content is inversely proportional to frequency (-3dB per octave or -10dB per decade).

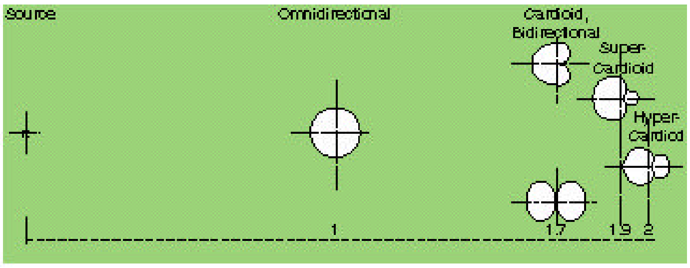
Polar Pattern

See "Directional Characteristic".

Polar patterns and direct/diffuse sound ratio

The ratio between direct and diffuse sound in a recording can be altered in two different ways: Either by the microphone's polar pattern or by the distance from the microphone to the sound source.

In popular music recordings, where it is customary to record instruments on separate tracks, acoustic leakage problems may occur when an ensemble is recorded simultaneously. While it may seem natural to use a directional microphone for maximum separation, the amount of leakage can also be controlled by altering the source-to-receiver distance. Since an omni directional microphone does not exhibit any proximity effects, it may be placed closer to the source without any colouration problems.



The illustration shows the relationship between the microphone's polar pattern and its distance to the sound source where the direct to indirect sound ratio is invariable. An omni directional microphone placed at a distance of 1 metre receives the same proportions of direct and diffuse sound as a cardioid microphone placed at 1.7 metres.

Polarisation Voltage

The (normally high) d.c. voltage applied to the back plate-diaphragm capacitor of a condenser microphone via a high resistance, thus setting up a fixed charge condition. Changes in the back plate-diaphragm distance due to pressure variations result in a varying output voltage v(t).

Prepolarization

A technique of depositing a fixed charge-carrying layer on either the diaphragm or back plate of a condenser microphone, thus eliminating the need for an external polarisation voltage. Such microphones are termed "prepolarized condenser microphones" or "electret microphones".

Pressure Microphone

A microphone in which only one side of the diaphragm is exposed to the impinging sound. The diaphragm responds the pressure variations uniformly and therefore pressure microphones are inherently omni directional. Also called "pressure operative microphone".

Pressure-gradient Microphone

A microphone in which both sides of the diaphragm are exposed to the incident sound and the microphone is therefore responsive to the pressure differential (gradient) between the two sides of the membrane. Sound incident parallel to the plane of the diaphragm produces no pressure differential, and so pressure-gradient microphones have characteristically figure-of-eight directional characteristics. Also called "velocity microphone", since the output voltage is proportional to the air particle velocity.

Proximity Effect

An inherent characteristic of pressure gradient microphones, resulting in a boost in the low-frequency response when the microphone is brought closer to a source. The effect becomes significant when the source-to-microphone distance is approximately the same as the wavelength of the impinging sound.

PZM - Pressure Zone Microphones

PZM microphones or boundary layer microphones are taking advantage of special acoustic phenomenons occurring at the surface of a boundary.

"PZM" microphones is used as a generic term for microphones taking advantage of the special acoustic phenomenons occurring directly at the surface of a plane boundary i.e. a floor or a wall. PZM microphones are therefore also called Boundary Layer Microphones. Normally PZM microphones are omni directional (pressure) microphones specially designed for this purpose with the diaphragm placed flush with the surface of a plate or a disc working as pressure zone. Also normal omni directional microphones will work fine as PZM's if for example taped to the floor or directly on a wall.

The advantages:

Direct sound waves meeting a hard plane boundary will be reflected at the surface causing a 6dB acoustic pressure increase. A microphone diaphragm will therefore have a 6dB higher sensitivity when placed in the pressure zone, than an equal microphone placed in the free field. Diffuse sound will not be reflected at a plane boundary as diffuse sound has no direction (per definition). The PZM microphone will therefore give direct sound 3dB higher level than diffuse sound. If used outdoors PZM microphones have better conditions than conventional microphones with regards to wind noises, as the wind velocity in principle is 0 (zero) on the surface of the ground.

Remote Miking

Placement of a microphone at a distance from the source, thereby picking up a larger proportion of the reflected sound. Also called "ambience miking".

Reverberation

Many repetitions of a sound successively closed in time. See "echo".

Reverberation Time

The time, in seconds, required for sound pressure at a specific frequency to decay a specified amount after a sound source is stopped. RT60, the time required for a decay of 60dB, is commonly used.

Root Mean Square (RMS)

The square root of the arithmetic average of a set of squared instantaneous values.

Rotating-head Recorder

By letting the recording head of a tape recorder move at an angle relative to the direction of tape transportation it is possible to record relatively high frequencies (>4MHz) with reasonably low tape speeds. This fact makes rotating-head recorders well suited for recording video and digital audio. However, with advances in the manufacturing technology of both tapes and narrow recording heads it is now possible to obtain the same bandwidth/tape consumption performance with stationary-head recorders. By reduction of the amount of moving parts reliability of these recorders is also improved.

Self-noise

See "Inherent noise"

Shock Mounting

Any system mounting or suspension which mechanically isolates equipment from unwanted vibration.

Sibilance

Noise associated with vocal sounding of words with characteristically "s", "sch", or "ch" syllables.

Signal-to-Noise Ratio

The ratio of the maximum signal that a system can record or reproduce to the inherent noise of that system. For digital systems it is usually defined as the ratio between RMS value of the highest recordable sine wave and the RMS value of the quantization noise.

Sound

Energy that is transmitted by pressure waves in air or other materials and is the objective cause of the sensation of hearing. Commonly called noise if it is unwanted.

Sound Level Meter

An electronic instrument for measuring the RMS level of sound, usually in accordance with an accepted national or international standard.

Sound Pressure

A dynamic variation in atmospheric pressure. The pressure at a point in space minus the static pressure at that point.

Sound Pressure Level (SPL)

The expression of sound pressure as dB referred to a pressure, p0, of 20microPa. SPL is defined as: Lp = 20 Logp/p0 dB Where p is the RMS value (unless otherwise stated) of sound pressure in Pascal's. Suffices (e.g. 20dB(A)) indicate that the SPL is weighted.

Sphere stereo

Two omni directional microphones placed diagonally in a solid Ø20 cm sphere simulating the acoustic field around the human head.

Sphere stereo is one of many head related stereo techniques. Two omni directional microphones are separated by a solid sphere with a diameter of Ø20 cm. The microphones are placed diagonally with their diaphragms flush with the surface of the sphere. The geometric dimensions used in this technique emulates the basic interaural proportions of a human head i.e. the interaural shadow effect and interaural time delay. Mostly the head related stereo techniques use directional microphones to accomplish these qualities, but as sphere stereo uses omni directional microphones, this technique can also be used as the main stereo pair at larger distances without loss of low frequencies. Unfortunately the rather large solid sphere will act as an acoustic equaliser which will colour the higher frequencies rather significantly. The sphere will not only cause a boost of higher frequencies, but will also introduce significant ripples on the frequency response.

Standing Wave

A periodic wave having a fixed distribution in space which is the result of interference of progressive waves of the same frequency and kind. Characterised by the existence of anti-nodes and nodes that are fixed in space.

Stereo 180

Two hyper-cardioid microphones spaced 4.5 cm and angled 135° creating the stereo image.

The Stereo 180 technique uses two hyper-cardioid microphones spaced 4.5 cm apart and angled at 135° to each other.

Time Difference Stereo

A spaced microphone stereo recording technique which uses left versus right time and phase differences of the acoustic signals to give cues which project to the listener a vivid stereo image. Also known as the "A-B stereo recording technique".

Total Harmonic Distortion (THD)

Distortion in non-linear systems where harmonic components (integer multiples of a fundamental frequency) are produced. THD is normally expressed as a percentage of the fundamental.

Trackability

The comparative phase response of a microphone pair. Also called "phase-matching".

Wavelength

The distance measured perpendicular to the wavefront in the direction of propagation between two successive points in the wave separated by one period. Equals the ratio of the speed of sound in the medium of the fundamental frequency.

The table shows the wavelengths in air and water at a given frequency.

Frequency (1/3 octave) [Hz]	Wavelengths in air (20°C) [m]	Wavelengths in salt water (20°C) [m]
16	12.4	97.4
20	17.2	77.9
25	13.7	62.3
31.5	10.9	49.5
40	8.58	39.0
50	6.86	31.2
63	5.44	24.7
80	4.29	19.5
100	3.43	15.6
125	2.74	12.5
160	2.14	9.74
200	1.72	7.79
250	1.37	6.23
315	1.09	4.95
400	85.8 cm	3.90
500	68.6 cm	3.12
600	54.4 cm	2.47
800	42.9 cm	1.95
1000	34.3 cm	1.56
1250	27.4 cm	1.25
1600	21.4 cm	97.4 cm
2000	17.2 cm	77.9 cm
2500	13.7 cm	62.3 cm
3150	10.9 cm	49.5 cm
4000	8.58 cm	39.0 cm
5000	6.86 cm	31.2 cm
6300	5.44 cm	24.7 cm
8000	4.29 cm	19.5 cm
10000	3.43 cm	15.6 cm
12500	2.74 cm	12.5 cm
16000	2.14 cm	9.74 cm
20000	1.72 cm	7.79 cm

Weighting Network

An electronic filter which gives different weighting to signals at different frequencies, commonly to approximate the frequency response of the human ear under defined conditions. The A-weighting network is most commonly used (as in dB(A)).

White Noise

Broadband noise having constant energy per unit of frequency.

XY stereo

Two first order cardioid microphones in the same point and angled 90° creating the stereo image.

XY stereo set-up is a coincidence stereo technique using two cardioid microphones in the same point and angled at 90° to produce a stereo image. Theoretically, the two microphone capsules need to be at exactly the same point to avoid any phase problems due to the distance between the capsules. As this is not possible, the best approximation to placing two microphones at the same point is to put one microphone on top of the other with the diaphragms vertically aligned. In this way, sound sources in the horizontal plane will be picked up as if the two microphones are placed at the same point.

The stereo image is produced by the off-axis attenuation of the cardioid microphones. While A-B stereo is a difference-in-time-stereo, the XY stereo is a difference-in-level-stereo. But as the off-axis attenuation of a first-order cardioid microphone is only 6dB in 90°, the channel separation is limited, and wide stereo images are not possible with this recording method. Therefore, XY stereo is often used where high mono-compatibility is needed - for example, in broadcasting situations where many listeners still receive the audio on mono equipment.

Since the sound-sources are mainly picked up off-axis when using the XY stereo setup, high demands are placed on the off-axis response of the microphones used. As described earlier, the use of directional microphones at large distances will reduce the amount of low frequency information in the recording, due to the proximity effect exhibited by the directional microphones.