AUDIO TRENDS

L E A R N I N G C E N T R E

Glossary of Audio Terms

Audio terminology can be very confusing and ambiguous. Below is a basic list of most common words related to audio specifications and terminology:

Acoustic suspension - a sealed or closed box speaker enclosure. Also referred to as an infinite baffle, Acoustic suspension speaker systems are generally less efficient than Bass Reflex or Transmission Line designs, but may offer greater accuracy with respect to bass tightness and reproduction.

Acoustics - the science or study of sound.

Alternating (AC) Current - currents that have harmonic time dependence.

Ampere (A) - the unit of measurement for electrical current in coulombs per second.

Amplifier - an electrical circuit designed to increase the current or voltage of an applied signal.

Amplitude - the relative magnitude of a signal.

Attenuation - the reduction of an electrical signal.

Audio frequency - the acoustic spectrum of human hearing, generally regarded to be between 20 Hz and 20 kHz.

Baffle - a board or other planar surface used to mount a loudspeaker.

Bandwidth - the range of frequencies reproduced by an amplifier or transducer.

Band-Pass Enclosure - type of enclosure used for subwoofers where the driver is completely inside the enclosure and all of the output emerges through a port(s). This configuration is usually designed for high output volume with importance of accuracy/fidelity being less emphasized.

Band-Pass filter - an electric circuit designed to pass only midrange frequencies. This filter acts as a high impedance to frequencies out of the pass band.

Bass (low frequencies) - The low end of the audio frequency spectrum between 0Hz to about 200 Hz.

Bass Reflex - *see ported enclosure*.

Bi-amping and bi-wiring - some higher performance speakers include dual sets of connectors, usually the type known as "binding posts," Models with dual connectors almost always also feature a special type of crossover with separate "high-pass" and "low-pass" sections. These connectors may also be shunted together with jumpers to accommodate conventional hook-ups.

Bi-wiring - low and high frequency sections of the loudspeaker are separated electrically at the cross-over. Each driver unit has its own filter section and connection terminals. Both sets of terminals are connected to one amplifier.

Bi-amping - an extension of bi-wiring in that a separate amplifier is utilized for each of the two sets of connectors from the cross-over.

Bi-pole - A speaker design which generates equal amounts of sound both forward and backward, with the two sounds being "in phase". See also *Di-pole.*

Capacitor - a charge storage device made up of two metallic plates separated by a dielectric, with equal but opposite charges. The AC impedance of a Capacitor is (1 / jWL) and acts as an open circuit in DC applications.

Circuit - a complete path that allows electrical current from one terminal of a voltage source to the other terminal.

Class A - transistor amp conducts for the entire cycle of input signal, conduction angle 360 deg. Runs hot, as the transistors in the power amp are on all the time, but has high sound quality.

Class B - positive and negative halves of the signal dealt with by different parts of the circuit, the output devices switching continually. Runs cooler, but the sound is not as pure.

Class AB - biasing the transistor amp at a non-zero DC current much smaller than the peek current of the signal source. Second transistor conducts during negative half cycle of waveform and the currents from the 2 transistors are combined at the load. A compromise between sound quality of Class A and efficiency of Class B. Most amp designs employ this method.

Clipping - a form of distortion caused by cutting off the peaks of audio signals. Clipping usually occurs in the amplifier when it's input signal is too large or when the voltage rails of the power supply cannot deliver the necessary voltage to the power amp.

Colouration - any change in the characteristic of sound that reduces naturalness, such as an overemphasis of certain tones.

Compliance - the relative stiffness of a speaker suspension, specified as Vas.

Cone - the conical diaphragm of a speaker attached to the voice coil which produces pulsation's of air that the ear detects as sound.

Crossover Frequency - the frequency at which the driver's roll off at - usually when response is down -3dB. See *Roll-off*.

Crossover Network (Filter) - an electric circuit or network that splits the audio frequencies into different bands for application to individual speakers. See *Electronic and Passive Crossover*.

Current (I) - the flow of electrical charge measured in amperes.

DAC - digital-to-analogue converter, turning on/off pulses into analogue sound. CD players have DACs built in. Separate DACs can upgrade a CD player or other digital player/ recorder, or can be used with dedicated CD transports.

Damping - the reduction of movement of a speaker cone, due either to the electromechanical characteristics of the speaker driver and suspension, the effects of frictional losses inside a speaker enclosure, and/or by electrical means.

Damping Factor - This is a quantity which defines how quickly the amplifier can stop a reproduced frequency such as a bass note. The higher the damping factor, the better the amp will control the woofer and help reduce overhang distortion. The damping factor of an amplifier is mostly dependent on the quality of the power supply which feeds the power amp.

Damping Material - any material added to the interior of a speaker enclosure to absorb sound and reduce out-of-phase reflection to the driver diaphragm (cone). Usually acoustic fibreglass, polyester batting, or Polyfill is used in speaker enclosures.

Decibel (dB) - (1) a logarithmic scale used to denote a change in the relative strength of an electric signal or acoustic wave. It is a standard unit for expressing the ratio between power and power level. Using the logarithmic relationship for power PdB = 10*log[Pout/Pin] , a doubling of electrical power only yields an increase of +3 dB. Increasing the power tenfold will yield an increase of +10 dB and is a doubling of perceived loudness. The decibel is not an absolute measurement, but indicates the relationship or ratio between two signal levels. (2) SPL (sound pressure level) can be measured in dB. 0 dB represents the threshold of normal human hearing, 130 dB represents the threshold for pain, 140 dB causes irreparable hearing damage, and 150 dB can cause instant deafness, anything greater than about 192 dB can kill you.

Diaphragm - the part of a dynamic loudspeaker attached to the voice coil that moves and produces the sound. It usually has the shape of a cone or dome.

Diffusion - The scattering of sound.

Di-pole - A speaker design which generates equal amounts of sound both forward and backward, with the two sounds being out of phase. Dipoles are often used as surround speakers. See also *Bi-pole*.

Direct Current (DC) - current in only one direction.

Diffraction - a change in the direction of a wave that is caused by the wave moving past or hitting an obstacle.

Dispersion - the spreading of sound waves as it leaves a speaker.

Distortion - any undesirable change or error in the reproduction of sound that alters the original signal.

Dome Tweeter - a high frequency speaker driver with a dome-shaped diaphragm usually made of metal or silk.

Driver - a loudspeaker unit, consisting of the electromagnetic components of a speaker, typically a magnet and voice coil.

Dynamic range - the range of sound intensity a system can reproduce without compressing or distorting the signal.

Efficiency rating - the loudspeaker parameter that shows the level of sound output when measured at a prescribed distance with a standard level of electrical energy fed into the speaker (usually recorded as XdB @ 2.83V input signal from 1 meter of distance. However, a driver with a high efficiency rating needs a larger box to play a lower frequency than a driver with a lower efficiency rating.

Electronic Crossover - uses active circuitry in addition to passive to filter unwanted signals for each driver. Usually active filters are employed as LPF (Low Pass Filters) for subwoofers or for the sub out of a preamp / receiver.

Enclosure - a box that contains the driver(s).

Equalizer - electronic device that acts as active filters used to boost or attenuate certain frequencies. Farad - the basic unit of capacitance. A capacitor has a value of one farad when it can store one coulomb of charge with one volt across it.

Filter - any electrical circuit or mechanical device that removes or attenuates energy at certain frequencies. See *Crossover Network*.

Flat Response - the faithful reproduction of an audio signal; specifically, the variations in output level of less than ±1 dB which is the threshold of human hearing sensitivity.

Free Air Resonance - the natural resonant frequency of a driver when operating outside an enclosure.

Frequency - the number of waves (or cycles) arriving at or passing a point in one second, expressed in hertz (Hz).

Frequency Response - the frequency range to which a system, or any part of it, can respond.

Fundamental Tone - the tone produced by the lowest frequency component of an audio signal .

Full-range - a speaker designed to reproduce all or most of the sound spectrum within human hearing (20Hz - 20KHz).

Ground - refers to a point of zero voltage or potential.

Group Delay - The group delay of a filter is a measurement of the average delay of the filter as a function of frequency. It is the negative first derivative of a filter's phase response.

Harmonic - the multiple frequencies of a given sound, created by the interaction of signal waveforms.

Harmonic Distortion - harmonics artificially added by an electrical circuit or speaker, and are generally undesirable. It is expressed as a percentage of the original signal. See *THD*.

Hertz (Hz) - a measurement of the frequency of sound vibration. One hertz is equal to one cycle per second. The hertz is named for H.R. Hertz, a German physicist.

High-pass Filter - an electric circuit that passes high frequencies but blocks low ones by acting as a large impedance to those frequencies. See *Band-pass* and *Low-pass filters*.

Hiss - background audio noise that sounds like a Rattler snake. Just hope it is an audio source causing it and not a Rattler snake for your sake!

Home Theatre - an audio system designed to reproduce the theatre sound experience while viewing movies in the home. A basic system usually consists of a Dolby Pro-logic Decoder, 5 speakers and a subwoofer. More advanced systems incorporate Dolby Digital/DTS and other discrete 5.1 channel surround formats.

Horn - a speaker design using its own funnel shaped conduit to amplify, disperse, or modify the sounds generated by the internal diaphragm of the speaker. In most cases, these type of speakers should be avoided in home audio.

Hum - audio noise that has a steady low frequency pitch.

Imaging - it is the speakers ability to localize different instruments playing simultaneously. See *Soundstage*.

Impedance - dependent on frequency, it is the AC equivalent of resistance in a DC circuit.

Inductance (L) - the capability of a coil to store energy in a magnetic field surrounding it. It produces an impedance to an AC current (jwL) and acts as a short circuit to DC. Inductors are commonly used in audio as low pass crossovers. See *Le*.

Infinite Baffle - a flat surface that completely isolates the back wave of a driver from the front.

Infrasonic (Subsonic) Filter - a filter designed to remove extremely low frequency usually between 8-25Hz or lower, noise from the audio signal. Useful for Ported box designs.

Input - connection from signal source.

Isobarik Enclosure - enclosure where one woofer is buried in the enclosure and a second is mounted up against the first and wired in reverse polarity (there are other variations for Isobarik designs), but this one works best. This allows the effective Vas of both drivers working in this push-pull configuration to be half that of a single identical driver mounted normally. Very small enclosures may be constructed as a result, with increased power handling. Less efficient than other designs, but the push pull configuration greatly reduces second order harmonic distortion. The name Isobarik comes from a term that means "constant pressure". See *push-pull*.

Low-Pass Filter - an electric circuit designed to pass only low frequencies and act as a high impedance to frequencies out of the filters pass-band. *See Band-pass and High-pass filters*.

Maximum power rating - a value which means almost nothing, but is used nonetheless by manufacturers to entice the unsuspecting into purchasing their product based solely on the big number. Technically, it is the maximum wattage that an audio component can deliver/handle as a brief burst during a musical peak. Most reputable manufacturers will provide both an RMS and Max power rating. Typically, the given value for the maximum power rating is twice to three times that of RMS.

Microfarads (mF) - a measurement of capacitance (XC*10^-6).

Midrange (mids) - the frequency range above bass but below treble that carries most of the identifying tones of music or speech. It is usually from 200Hz to 4kHz.

Millihenries (mH) - a measurement of inductance (XL*10^-3).

Mms - the moving mass of a driver assembly.

Mono - monophonic sound. A method for reproducing sound where the signals from all directions or sources are blended into a single channel.

MOFSET - Metal Oxide Semiconductor Field Effect Transistors. Used in most modern, quality car audio amplifiers in the power supply (and sometimes in the output stage). MOSFET's run cooler than normal bipolar transistors, and have a faster switching speeds and higher slew rates.

Octave - a range of tones where the highest tone occurs at twice the frequency of the lowest tone.

Ohm - a unit of electrical resistance or impedance.

Ohm's Law - a basic law of electric circuits. It states that: the current [I] in amperes in a circuit is equal to the voltage [V] in volts divided by the resistance [R] in ohms; thus, I = V/R.

Oversampling - used in DAC systems. Increases signal frequency, making it easier for conversion circuitry and ancillary systems to filter out unwanted signals.

Out of Phase - when your speakers are mounted in reverse polarity, i.e., one speaker is wired +/+ and -/- from the amp and the other is wired +/- and -/+. Bass response will be very thin due to cancellation.

Output - the sound level produced by a loudspeaker.

Passive Crossover - uses inductors (coils) and capacitors to direct proper frequencies to appropriate drivers. These crossover systems can be simple (First Order = 1 component @ -6 dB/octave slope) to complex (Fourth Order = 4 components @ -24 dB/octave slope).

Passive Radiator - a device that looks just like an ordinary driver, except it has no magnet or voice coil. A radiator is usually a highly compliant device, with a similar cone material and surround found on regular active drivers. The radiator must usually be at least as large (or larger) than the driver it is aligned with. The passive radiator is tuned to Fb and used in place of a port, providing bass reinforcement for the driver in a similar fashion as any regular ported box. A clear advantage of the radiator is the absence of port noise, and some audiophiles claim the radiator provides a better sounding bass than a ported enclosure. Disadvantages include difficulty in tuning, and the extra required baffle area for the radiator. Most radiators can be tuned with either weights or silicone, adding material in a balanced manner until Fb is attained.

Peak - the maximum amplitude of a voltage or current.

Phase - Refers to the timing relationship of two or more signals or soundwaves. It's especially important to be sure that your stereo speakers are playing "in phase." This means that the drivers (cones and domes) of your right and left speakers are moving in and out at the same time. If your speakers are "out of phase" you'll hear significantly less bass, and instead of producing a strong centre image, the sound tends to stay localized at the speakers.

Phase Coherence - the relationship and timing of sounds that come from different drivers (subs, mids, tweeters) mounted in different locations in the vehicle.

Phase Distortion - a type of audible distortion caused by time delay between various parts of the signal; can be caused by equalizers.

PMPO - stands for peak music power output, used on gear that needs to look more powerful than it is. If you see a boom -box, computer speakers or car receivers advertising power rated like this, ignore it.

Polarity - the orientation of magnetic or electric fields. The polarity of the incoming audio signal determines the direction of movement of the speaker cone. Must be observed when wiring speakers, so that they are "in phase". See *Out of Phase*.

Ported Enclosure - a type of speaker enclosure that uses a duct or port to improve efficiency at low frequencies. Excellent design for lower power systems, as the port often adds up to +3 dB to low frequency efficiency. F3 can be set considerably lower with proper design, although low frequency roll-off is generally -24 dB/octave. Good transient response with proper tuning, although the driver loses damping below the tuning frequency. Excellent power handling about Fb, but source material or frequencies below Fb cause the driver to progressively perform as if it were not enclosed at all. Due to this, ported enclosures without a low frequency filter may have lower power handling compared to other designs. More difficult to properly build and tune than a sealed enclosure, with several "optimum" alignments available depending upon the Qts of the driver.

Power (P) - the time rate at which work is done or the rate at which energy is used. Basic equations for Electrical Power are: P = V^2/R or P = I^2*R.

Resonance - the tendency of an object to vibrate most at a particular frequency.

Resonance Frequency - the frequency at which the speaker tends to vibrate most at a certain frequency.

Resistance (Re) - in electrical or electronic circuits, a characteristic of a material that opposes the flow of electrons. The higher the gauge of wire, the less cross sectional area contributing to DC series resistance (DCR).

RMS - an acronym for "root mean square." Used in audio to help rate the continuous power output of an amplifier or input capability of speakers. This is the preferred method for comparing anything in audio applications.

Roll-off (cut-off) - the attenuation that occurs at the lower or upper frequency range of a driver, network, or system. The roll-off frequency is usually defined as the frequency where response is reduced by -3 dB.

Sampling rate - how fast a digital recorder or player samples a signal. CD, DCC and Mini Disc use a rate of 44.1kHz - ie 44,100 samples per second - while DAT recorders offer a choice of 48kHz or 44.1kHz, and Digital Audio Broadcasting will work on 32kHz. A digital-to-analogue converter needs to work on all three rates. The sampling rate determines the highest frequency recordable a digital system can carry - hence the development of higher-sampling formats, such as Pioneer's 96kHz system, for better treble extension.

Satellite speaker - A small speaker with limited bass response, often designed to be used with a matching subwoofer.

Sealed enclosure - air tight enclosure that completely isolates the back wave of the driver from the front. Very tight, defined sound (with Qtc = 0.707) with very good transient response and power handling. Low frequency roll-off is at -12 dB/octave. Less efficient than other designs, and higher distortion levels at resonance. Easy to design and build.

Sensitivity - The sound pressure level directly in front of the speaker (on axis) at a given distance (usually 1 meter) produced by a given amount of power (usually 1 watt).

Signal-to-noise (S/N) - the ratio, expressed in dB, between the signal and noise.

Sine wave - the waveform of a pure alternating current or voltage. It deviates about a zero point to a positive value and a negative value. Audio signals are sine waves or combinations of sine waves.

Single Reflex Band-pass Enclosure - sometimes called a 4th order band-pass. A design where the driver is completely "buried" in the enclosure, mounted in a sealed chamber (Vr) and firing into a second ported chamber with the sound emanating from one or more ports. This second chamber (Vf) is tuned to the sealed drivers Fcb. Band-pass enclosures pass only a limited range of frequencies, negating the need for crossovers in the circuit. In a typical single reflex band-pass, the cut off rate below and above the "pass-band" is at a rate of -12dB/octave. These designs are very efficient within the operating bandwidth, with superior power handling, but generally inferior transient response to sealed (all the sound has to come out of the vent). Transient response can be very good if the enclosure is configured with a S of 0.70. Can be very difficult to design and build.

Slew Rate - This is a term used to describe how quickly the output of an amplifier can track its input. Slew Rate is usually measured in V / msec. The higher the value, the better the amp is at reproducing the subtle nuances and dynamics associated with music reproduction

Sound Pressure Level (SPL) - the loudness of an acoustic wave stated in dB that is proportional to the logarithm of its intensity.

Sound Stage - the sound systems ability recreate an imaginary stage. A good speaker will faithfully make the stage seem close to the actual height, width and depth of the actual performance stage where recorded. Imaging is similar, but the speaker must be able to place each instrument or voice in the correct location on the soundstage. The reproduction of the way the music would sound if you were actually watching the musicians play in front of you. The stage should always appear to be in front of you, with a proper "image" of where each musician is playing on the imaginary soundstage.

Spider - the flexible material that supports the former, voice coil, and inside portion of the cone within the speaker frame.

Standing wave - a build up of sound level at a particular frequency that is dependent upon the dimensions of a resonant room, car interior, or enclosure. It occurs when the rate of energy loss equals the rate of energy input into the system. This is what you hear when you listen into a sea shell.

Subwoofer - a loudspeaker designed to reproduce bass frequencies.

Surround (suspension) - the outer suspension of a speaker cone; holds the diaphragm in place but allows it to move when activated. Usually made of foam or rubber.

Timbre - The quality of a sound related to its harmonic structure. Timbre is what gives a voice or instrument its sonic signature -- why a trumpet and a saxophone sound different when they play the same note.

Three-way - a type of speaker system composed of three ranges of speakers, specifically a woofer, midrange, and tweeter.

Total Harmonic Distortion (THD) - the RMS value of the harmonic components of the output signal, excluding the fundamental, expressed as a percentage of the RMS of the fundamental.

Transient Response - the ability of a speaker to respond to any sudden change in the signal without blurring (smearing) the sound. A speaker that can react quickly to rapid changes in sound has "good transient response".

Transmission Line Enclosure - a design in which the driver is at one end of the enclosure, with an internal path which consists of a series of bends or curves that lead to a port at the other end of the enclosure. The path length is a fraction of the wavelength at low frequencies. The length of the path is increased by stuffing the box with either long fibre wool or polyester batting, and produces a phase shift in the back wave that reinforces bass at low frequencies. Enclosures must be very large, but low end response of these systems is legendary among audiophiles. Drivers with Qts of less than 0.4 that work well in ported should work well in these designs, but no standardized method for configuring these enclosures exists that engineers have yet to agree upon. Power handling is generally less than in other designs, but drivers may be capable of responding down to Fs. One of the most difficult enclosures to design and build, and much experimentation may be necessary to get things right. "Labyrinths" and "Tapered (Stuffed) Pipes" are both variants of this type of enclosure.

Treble (highs) - the upper end of the audio spectrum reproduced by tweeters, usually 3 - 4 kHz and up.

Tweeter - a speaker designed to reproduce the high or treble range of the sound spectrum.

Two-way - a type of speaker system composed of two ranges of speakers, usually a woofer and tweeter.

Voice-matched - Speakers that are "voice-matched" have a similar timbre or tonal quality. Voice-matched speakers in a home theatre system will result in more seamless, consistent, convincing wraparound sound.

Voice coil - the wire wound around the speaker former. The former is mechanically connected to the speaker cone and causes the cone to vibrate in response to the audio current in the voice coil.

Volt (E) - a unit of measurement used to measure how much "pressure" is used to force electricity through a circuit.

Watt - a unit of electrical power. A watt of electrical power is the use of one joule of energy per second. Watts of electrical power equals volts times amperes.

Wavelength - the length of a sound wave in air. It can be found for any frequency by dividing the speed of sound in air (1120 feet per second) by the frequency of the sound, or: WL = 1120 / Freq.

Woofer - a loudspeaker transducer designed to reproduce low-frequency sounds.

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