

GLOSSARY OF ELECTRONIC TERMS

This glossary of electronic terms was designed to be used in conjunction with the articles in this issue. Definitions were prepared with the assistance of Milton Babbitt, Composer, and James Searright, Technical Supervisor, of the Electronics Music Center of Columbia and Princeton Universities, and H. Emerson Meyers, Professor of Music and Director of the Electronic Music Laboratory, The Catholic University of America, Washington, D.C. Recommended source book for electronic terminology: *The Audio Cyclopaedia* by Howard M. Trzaskaine, Indianapolis, Indiana; Howard W. Sams, 1958. Distributed by Bobbs-Merrill, Indianapolis.—Ed.

acoustics. The study of production, transmission, and reception of sounds. Psychoacoustics deals with the effects of sound on humans.

amplifier. A device used to increase the power, voltage, or current of a signal.

amplitude. Usually equated with loudness; it refers to the maximum value of a power, voltage, or current during a single cycle of a wave.

amplitude modulation. The periodic variation of amplitude, or the process by which this is achieved. It refers to the alteration of signal amplitude to affect loudness, beauty, in electronic music, in the nature of a tremolo whose periodicity and amplitude alterations are exactly controllable by audio equipment.

analog computer. A computer in which computation is effected by measuring and processing physical quantities such as voltages, whereas in digital computers, numbers or numerical representations are manipulated to effect computation. The analog computer deals with continuously variable information rather than with digital information.

analog tape. A magnetic tape on which information is stored in continuous form on magnetic densities. The common tape used in a tape recorder is an analog tape.

attack. Those amplitude characteristics having to do with the beginning of a sound or signal (sometimes called growth).

audio generator. Strictly speaking, an electronic device that produces complex (that is, non-sinusoidal) signals at frequencies between 20 and 20,000 Hz. The terms oscillator and generator are frequently used interchangeably, but correct usage is that oscillator refers to a generator of sine waves, whereas generator refers to a device that produces other than sine waves.

audio oscillator. A device that produces sinusoidal signals at frequencies between 20 and 20,000 Hz, normally for purposes of sound synthesis or testing.

audio spectrum. The entire range of oscillations that can be heard by the human ear. The extreme limits of human hearing are about 20-20,000 Hz.

band-elimination (reject) filter. A filter that attenuates a particular band of frequencies, while permitting other frequencies to pass and be heard. (See, filter.)

band-pass filter. A filter that attenuates all but a particular band of frequencies. The opposite of a band-elimination filter. (See, filter.)

binary input language. A two-character language used to convey instruction to electronic equipment. A convenient language to use since the two characters may be represented by the two states of a switch (on or off), the presence or absence of a hole in a paper tape, and so on.

contact microphones. A microphone that must be placed in physical contact with a vibrating body (violin, guitar, cymbal, and the like), thereby transforming vibrations into electrical signals.

conversion. The process by which digitally stored information is transformed into analog information or vice versa.

decay. Those amplitude characteristics having to do with the ending of a sound or signal.

digital tape. Magnetic tape on which information is stored in discrete, numerical form (as differentiated from analog tape).

drift. Any gradual, unintentional shifting away from a desired value due to equipment shortcomings. In electronic music, reference is generally to oscillator frequency drift.

echo. The discernible replication of sounds usually at a lower amplitude. (See, reverberation.)

electronic switch. A device used to produce a periodic interruption of a signal.

electroacoustics. A term covering the whole field of electrically produced sounds, whether they represent sonic experiments, sound effects, or music.

envelope. Those characteristics of amplitude that determine the growth and decay of a signal. The contours of a sound or sounds include such variables as rate of attack time, attack height, frequency, timbre, sustain level, rate of initial decay, and also the rate of final decay.

equalizer. A device for increasing or decreasing signal strength in selected portions of the audible spectrum. Certain frequencies may be strengthened in amplitude while others may be diminished. (See, Fletcher-Munson curve.)

erase head. The head of a tape recorder that erases previously recorded material on the tape prior to its passing the record head.

event. A single, perceptually separable musical entity in all of its dimensions; that is, pitch, duration, loudness, timbre, and so on.

feedback. The reaction of the output or part of the output of an amplifying device upon the input to secure either reinforcement (positive feedback) or reduction (negative feedback) of the original input. The term, as commonly used in electronic music, refers to the practice of sending a portion of the playback signal from a tape recorder back around to the input with the machine is running in the second mode. The playback signal is re-recorded and again played back, and so on, at an interval of time corresponding to the distance between the record and playback heads, and the speed of the tape. The effect is that of a series of echoes of the original sound, either dying away or increasing to an avalanche of sound, depending on the loop gain of the feedback system.

filter. A device that permits the selective transmission of certain frequencies of the input signal by the attenuation of undesired frequencies. (See, band-pass filter, band-elimination filter.)

Fletcher-Munson curve. A diagram of equal contours that displays the relationship between intensity and loudness (perceived intensity) at varying (musical) frequencies. A group of sensitivity curves made of the human ear showing its characteristic for different intensity levels between the threshold of hearing and the threshold of feeling.

four-track tape. Recording tape on which four separate sound paths can be utilized at the same time for recording and playback. (See, quarter-track recorder.)

frequency. Vibrations per second of a signal. The frequency of a signal usually determines its pitch.

frequency counter. A device that measures the frequency of a signal by literally counting the individual oscillations that occur during a precisely determined time interval.

frequency modulation. The periodic variation of signal frequency affecting pitch. (See, amplitude modulation.)

frequency shift. A change in frequency of an input signal accomplished by a multiplier-type modulator or frequency shifter (*Klangverschieber*).

gain. A quantity expressing the degree of amplification of an amplifier or device. Gain may be positive or negative, although negative gain is usually referred to as loss.

gate. A device for controlling the amplitude (loudness) of a signal path. Voltage-controlled amplifiers are sometimes called gates.

half-track recorder. A tape recorder that records and plays on half of a one-fourth-inch magnetic tape. Two-track or stereo recorders are sometimes referred to as "half-track" if the width of each channel is actually one-half of the tape width. Generally, however, half-track recorders are monaural.

half-track heads. The heads on a half-track tape recorder.

harmonic. An overtone, or frequency component present in complex sounds. The frequency of a harmonic is an integral multiple of the fundamental frequency, which is the lowest frequency partial present in a given sound. All harmonics are necessarily partials.

Hertz. A term used internationally in place of "cycles per second." Hertz (Hz) derives from the name of the German scientist Heinrich Rudolph Hertz, who was first to detect, create, and measure electromagnetic waves.

input. A signal fed into a circuit or device.

input language. The code employed to convey instructions when programming an electronic device. An encoding language such as Fortran or Cobol.

jack. A plug-in type terminal such as is found on telephones switchboards. A socket-type connector to

which temporary connections may be made with patch cords.

bay gears. A device for punching information on computer data cards.

Changefrequency. A succession of musical events usually having different instantaneous pitches associated with each event. The use of drums as the primary compositional material; timbre used thematically.

Changefrequency. A ring modulator-like device (see below) in which one set of resultant frequencies is suppressed.

Linear comb filter. A device for continuously varying properties of sound. As manufactured by the R. A. Moog Company, fingerdrums are moved along gold contact wires to vary electrical current.

magnetic tape. Iron-oxide-coated plastic tape used in magnetic recordings. Standard widths are one-quarter, one-half, and one inch.

mixer. A device for combining several input signals by algebraically summing their instantaneous amplitudes.

modulation. The process in which a characteristic of a waveform is (usually periodically) varied. (See, amplitude modulation; also, frequency modulation.)

monitor. A device used for checking audio signals, usually during the recording process.

musique concrete. Music that is constructed from recorded sound sources, other than purely electronic, material. The transformation of sound by radical changes.

noise. Undesired sound. (See, white noise.)

oscillator. (See, audio oscillator; ring; audio generator.)

oscilloscope. An instrument that reproduces on the screen of a cathode-ray tube a graphical representation of signals as voltages with respect to time. Used to determine amplitude, frequency, and other waveform characteristics.

output. The signal that comes out of a circuit or device.

parameter. A variable quantity that can be measured.

partial. A frequency component, not necessarily harmonically related to other components.

patch cord. A cord with a plug at both ends used to establish a temporary connection between two jacks, usually between an output and an input.

peak. The maximum value of amplitude, or a momentary value considerably higher than the average.

periodicity. The alteration or changing of variation in sounds or structures.

pitch succession. The consecutive sounding of two or more notes.

potentiometer. A device used for the precise measurement of voltages by comparison of an unknown voltage with a reference voltage. Often commonly used to denote a volume control on audio equipment (abbreviated "pot").

programming. The directions for the sequential behavior of an electronic system, particularly a computer.

punched paper tape programmer. An instrument that stores information by means of coded holes in a paper tape.

quarter-track recorder. A tape recorder that uses one-quarter (rather than one-half, or all) the width of the tape for each recording. Some recording requires simultaneous recording on two of the four tracks.

Many "four-track" recorders should properly be called quarter-track, as a four-track machine must be capable of simultaneous use of all four tracks on the tape.

recording head. An electromagnetically transducer used to imprint magnetized patterns on recording tape.

The playback head "reads" the results of such arrangements.

repetition. Repetitions of sound that are so closely spaced in time that they cannot be distinguished individually. The effect produced by multiple overlapping echoes in a room or concert hall. (See, echo.)

reverberation unit. A device that artificially produces the effect of reverberation upon signals passed through it.

ring modulator. An analog multiplier circuit used to combine signals in such a way that the output consists of sums and differences of all the input frequency components.

sevenfold wave. A signal consisting of a fundamental frequency and all harmonics, with the intensities of the harmonics inversely related to frequency. (See, waveform.)

Self-sync. In a normal three-head, multi-track tape recorder, the signal played back during monitoring is delayed by an interval of time corresponding to the distance between the recording and playback heads, and the speed of the tape. If it is desired to record a signal on a second track while listening to the first track as a guide for synchronization it will be found that the time delay error is about one-sixth of a second (at 7 1/2 ips.) and the second track will be out of synchronization by that amount. In order to avoid this, circuits have been developed to allow the playback from the first track (or any track) to be made from the recording head, by using it as a playback head. The sound heard will then be synchronous with the recording of another signal on another track, as the record heads are all in line vertically with each other. Of course there are problems in so using the second head as a playback head; only in the finest machines is the signal quality usable at all for other than the crudest guide to synchronization. The term "Self-sync" refers to such a system.

sequencer. A device that is used to produce a preset voltage sequence for the purpose of controlling a series of events with voltage-controlled equipment.

signal. Electrical analog of sound.

signal generator. The source of sound; an oscillator or, even a tape recorder in a very general sense.

same wave. The waveform corresponding to a single frequency oscillation.

sound. Pressure waves of a frequency audible by the human ear. The properties of sound are frequency, amplitude, duration, and timbre or waveform. When frequency of vibration is regular or stable, pitch results; when unstable, notes result.

same-as-again. A method of recording a second signal on top of a previously recorded track of a tape. The erase head of the tape recorder must be disconnected or disabled to prevent erasure of the first signal during the process of recording the second. The results are usually quite poor in terms of signal quality.

sound waves. The periodic compression and rarefaction of the atmosphere at frequencies discernible to the human ear.

source. The entity that supplies signals.

spectrum. A frequency representation of the (audio) signal which plots amplitude against frequency; the conversion from the waveform to the spectrum representation is achieved mathematically by a Fourier transformation.

splice. The connection of two segments of magnetic tape, usually with the help of special splicing tape that is adhered to the glossy back surface.

square wave. A signal consisting of a fundamental frequency and all odd-numbered harmonics with the intensities of the harmonics inversely related to frequency.

steady-state. That portion of a sound or signal that lacks significant perceived variations.

synchronization. Coordinating with regard to time one set of events with another.

synthesizer. A system of electronic instruments for the production and control of sound.

tape deck. The tape transport and heads portion of a tape recorder. Sometimes preamplifiers are included, but not power amplifiers and speakers usually present in portable machines.

time-lapse. A device used in tape recording to increase or decrease performance speed without altering pitch. The reverse operation is also possible and pitch may be altered without altering speed.

timbre. Tone-color. Timbre is the complex function of the relative amplitudes and frequencies of the frequency components.

timbre modulation. The alteration of the amplitudes and frequencies of frequency components to affect perceived tone-color.

transient structure. Overtones (harmonics) momentarily present, usually during the attack of a sound. (See, steady-state.)

transistor. A device made from semiconductor materials that can act as an electrical insulator or conductor, depending on the electrical charges placed upon it. Transistors are used in amplification and oscillation as a substitute for vacuum tubes.

variable speed unit. A device used to control the speed of a tape recorder motor. Professional tape recorders are driven by a synchronous motor whose speed is dependent on the frequency of the AC power to it.

Most variable speed units consist of an oscillator that furnishes a frequency between, roughly, 30 and 40 Hz, and a power amplifier that amplifies this signal to a level of 117 volts at a power sufficient to drive the motor. Variation of the oscillator within this frequency range will affect the speed of the motor over a three to one range, usually without ill effects.

variac. A variable AC transformer, sometimes used to control the speed of a tape recorder motor by reducing the 117-volt line voltage. This method will usually shorten the life of the motor.

vocoder. Developed in the early 1950's to break down complex vocal sounds into digital bits of information for transmission over narrow bandwidths by wire or by radio. Used as a variation device in electronic music composition.

voltage-controlled amplifier. An amplifier whose gain may be varied by means of a change in a control voltage.

waveform. The shape of a wave in the sense of a graphical representation showing variations in amplitude versus time.

white noise. By analogy with light, a signal that may be considered to contain all audible frequencies, with amplitudes randomly distributed. Colored noise, analogously, is noise in which a band (or bands) of frequencies is suppressed. The audible effect of white noise is like that of sweeping steam.

wye (Y) connector. A device having the appearance of the letter "Y" at the ends and bottom of the wye are three connectors, all connected in parallel at the intersection. Should not be used for mixing signals, but for dividing a signal to send it to more than one place.

which temporary connections may be made with patch cords.

key punch. A device for punching information on computer data cards.

Klangfarbenmelodie. A succession of musical events usually having different instrumental timbres associated with each event. The use of timbre as the primary compositional material; timbre used thematically.

Klangumwandler. A ring modulation-like device (see below) in which one set of resultant frequencies is suppressed.

linear controller. A device for continuously varying properties of sound. As manufactured by the R. A. Moog Company, fingertips are moved along gold contact wires to vary electrical current.

magnetic tape. Iron-oxide-coated plastic tape used in magnetic recordings. Standard widths are one-quarter, one-half, and one inch.

mixer. A device for combining several input signals by algebraically summing their instantaneous amplitudes.

modulation. The process in which a characteristic of a waveform is (usually periodically) varied. (See, amplitude modulation; also, frequency modulation.)

monitor. A device used for checking audio signals, usually during the recording process.

musique concrète. Music that is constructed from recorded sound sources, other than purely electronic.

mutation. The transformation of sound by radical change.

noise. Undesired sound. (See, white noise.)

oscillator. (See, audio oscillator; also, audio generator.)

oscilloscope. An instrument that reproduces on the screen of a cathode-ray tube a graphical representation of signals as voltages with respect to time. Used to determine amplitude, frequency, and other waveform characteristics.

output. The signal that comes out of a circuit or device.

parameter. A variable quantity that can be measured.

partial. A frequency component, not necessarily harmonically related to other components.

patch cord. A cord with a plug at both ends used to establish a temporary connection between two jacks, usually between an output and an input.

peak. The maximum value of amplitude, or a momentary value considerably higher than the average.

permutation. The alteration or changing of variables in sounds or structures.

pitch succession. The consecutive sounding of two or more tones.

potentiometer. A device used for the precise measurement of voltages by comparison of an unknown voltage with a reference voltage. Often commonly used to denote a volume control on audio equipment (abbreviated "pot").

programming. The directions for the sequential behavior of an electronic system, particularly a computer.

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The playback head "reads" the results of such arrangements.

reverberation. Repetitions of sound that are so closely spaced in time that they cannot be distinguished individually. The effect produced by multiple overlapping echoes in a room or concert hall. (See, echo.)

reverberation unit. A device that artificially produces the effect of reverberation upon signals passed through it.

ring modulator. An analog multiplier circuit used to combine signals in such a way that the output consists of sums and differences of all the input frequency components.

sawtooth wave. A signal consisting of a fundamental frequency and all harmonics, with the intensities of the harmonics inversely related to frequency. (See, waveform.)

Self-sync. In a normal, three-head, multi-track tape recorder, the signal played back during monitoring is delayed by an interval of time corresponding to the distance between the recording and playback heads, and the speed of the tape. If it is desired to record a signal on a second track while listening to the first track as a guide for synchronization it will be found that the time delay error is about one-tenth of a second (at 15 ips.) and the second track will be out of synchronism by that amount. In order to avoid this, circuits have been developed to allow the playback from the first track (or any track) to be made from the recording head, by using it as a playback head. The sound heard will then be synchronous with the recording of another signal on another track, as the record heads are all in line vertically with each other. Of course there are problems in so using the second head as a playback head; only in the finest machines is the signal quality usable at all for other than the crudest guide to synchronization. The term Self-sync* refers to such a system.

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signal generator. The source of sound; an oscillator or, even a tape recorder in a very general sense.

sine wave. The waveform corresponding to a single frequency oscillation.

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sound-on-sound. A method of recording a second signal on top of a previously recorded track of a tape. The erase head of the tape recorder must be disconnected or disabled to prevent erasure of the first signal during the process of recording the second. The results are usually quite poor in terms of signal quality.

sound wave. The periodic compression and rarefaction of the atmosphere at frequencies discernible to the human ear.

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