REFERENCES FOR CREATIVE SOUND

Prepared by:

Ralph Jones
Creative Sound Artist/Teacher
New York State Summer School of the Arts
School of Film/Media
The Division of Humanities and Arts Education
State Education Department
Albany, New York 12234

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Contents:

VOCABULARY OF THE SOUND STUDIO

An AUDIO signal is transmitted as an alternating (AC) voltage; CONTROL signals and POWER SUPPLY voltages are usually direct (DC) voltages. LEVEL is synonymous with AMPLITUDE or strength in describing a signal. The level of a DC voltage refers to its instantaneous magnitude; the level of an AC voltage refers to its RMS or average magnitude, or alternately, its PEAK-TO-PEAK magnitude. "Level" is not used in referring to power supply or other voltages which carry no information. A device's INPUT is rated according to the optimum level of signal for which it was designed, and sometimes also for the maximum level that it can accept without exceeding a certain percentage of distortion. A device's OUTPUT is rated according to the maximum level that it can deliver without excessive distortion. Two units of level are commonly used: the volt and the decibel. The VOLT is a measure of electrical force, while the DECIBEL, in present-day practice, is a measure of the logarithm of the ratio of the voltage to some standard, the standard to be specified with the units in usage. Common audio practice takes 0db (the reference) to be that voltage which appears across a 600-ohm resistor which is dissipating one milliwatt of power (hence dbm: db re one milliwatt), or .774 volt. An increase of 20db in signal level corresponds to an increase in voltage by a factor of 10; an increase of 6db corresponds to a factor of 2 increase in voltage. The standardization of signal levels among the instruments in a studio contributes to operating convenience and minimization of noise and overload problems. The standard level in a given studio is called LINE LEVEL. Most professional audio equipment, and some semi-professional equipment, is designed to work with a line level of +4db or +8db (re one milliwatt), since those signal levels are readily produced and yet are high enough to mask the spurious noises that are generally present. Microphones, phonograph pickups, tape reproduce heads, and other transducers normally produce signals of a much lower level than +4db, and require PREAMPLIFICATION to be consistent with line level. On the other hand, speakers require levels well in excess of +8db, and POWER AMPLIFIERS are used to raise line level signals to a level suitable to drive them.

In any device using non-linear components (this includes virtually all studio equipment), the signal is distorted and additional frequencies (HARMONICS and MODULATION PRODUCTS) are produced. DISTORTION is generally specified as a percentage of the desired signal. While some types of distortion are less audible than others, distortion of less than 1% is generally considered inaudible, while greater than 2% is audible. Distortion is added to the signal by every device through which it passes. On one point on the distortion-versus-signal-level graph of a device, distortion rises rapidly for small increases in signal level. This point is called the OVERLOAD LEVEL of the device.

VOCABULARY (cont.)

Of the unwanted output of a device, NOISE is that portion whose level remains constant with respect to input signal level variations. Generally two types of noise are present: random fluctuations (a pitchless hiss, crackle, or roar), and power line and other extraneous pickup (a pitched hum or whine). While hum pickup may be reduced significantly by shielding or other straightforward measures, random fluctuations are a physical characteristic of electronic devices. Noise is generally specified in one of two ways. EQUIVALENT INPUT NOISE is the level of a noise signal at the input of a device (assuming it to be noise-free) that would be required in order to generate that level of noise that is measured at the output -- generally, specified in microvolts. Noise can also be specified in terms of the ratio between the noise level present at the output of the device and the signal level produced at the output at the onset of overload. This ratio is called the DYNAMIC RANGE or SIGNAL-TO-NOISE RATIO of the device, and may lie between 60 and 120db.

An INPUT or LOAD receives information; an OUTPUT or SOURCE supplies information. The IMPEDANCE of an input is a measure of the voltage (AC) across it required to produce a given amount of current flow through it. The output impedance of a device is the impedance which would be observed at the output if the device were producing no signal. The unit of impedance is the ohm (Ω). As with line level, it is advantageous to standardize impedance within a studio. The standard, or line, impedance of professional audio devices may be between 50 and 600 ohms. It is selected for a given studio on technical considerations. The matching of impedances of an input and output is necessary only if the transmission line is long, or if the signal level is low (e.g., microphone impedances should be matched). With line level equipment, however, it is permissible to have all inputs high impedance, enabling one output to feed many inputs.

An AMPLIFIER is a device which increases the level of a signal; an ATTENUATOR is a device which decreases signal level. A PRE-AMPLIFIER raises low level signals to line level; a POWER AMPLIFIER raises line level signals to a level suitable to drive speakers. GAIN is the ratio of the output signal level of a device to the input signal level required to produce that output level, expressed in decibels. Similarly, ATTENUATION is the input-output level ratio of an attenuator. INSERTION LOSS is the minimum attenuation caused by insertion of the component into the circuit.

Mechanically activated attenuators are referred to as CONTROLS or POTENTIOMETERS (POTS). A PAN POT has one input and two outputs, and is used to smoothly move the input from one output to the other.

EQUALIZATION is the tailoring of the frequency characteristics of a signal; tone controls are a form of equalization.

VU METERS indicate the level of a signal in "volume units", a logarithmic but arbitrary unit. Occasionally, VU meters are calibrated in decibels.

VOCABULARY (cont.)

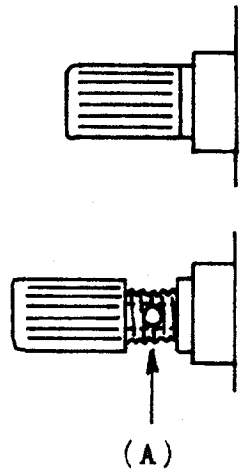
The PHASE of a signal (AC only) is a measure of the position of the signal in time at a given instant with respect to some reference, and is usually specified in degrees: a 360 degree phase difference equals one period of repetition ("phase" in degrees properly applies to PERIODIC WAVEFORMS, i.e., waveforms seen to be repetitions of a single waveshape). Two signals are properly in phase when the phase difference between them is 0 or some integral multiple of 360 degrees; otherwise, they are out of phase. In a common but incorrect usage, two signals are said to be out of phase when no phase difference exists between them, but one is the algebraic negative of the other (INVERTED). This usage is most often applied to amplifier outputs, where POLARITY, rather than true phase shift, is involved.
A FLOATING OUTPUT is one in which the voltage produced is not referenced to GROUND (0 volts, the fundamental voltage reference in any electronic system), or to any other reference. A BALANCED OUTPUT is one in which two voltages of opposite polarity are produced; only one voltage is produced at an UNBALANCED OUTPUT. Both balanced and unbalanced outputs are normally ground-referenced.

CHART OF COMMON AUDIO CONNECTORS

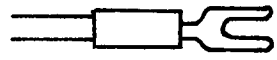
(male) (female)

1 Terminal

BANANA -- Found on some test equipment, speaker output terminals on power amplifiers, and as connection terminals on speakers. Bare wire may be attached to the (panel-mounted) female by inserting at hole "A" (see figure at right), and tightening thumbnut to clamp wire securely.

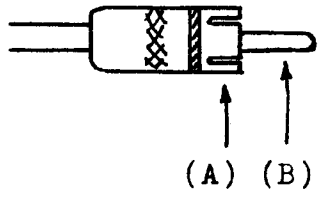


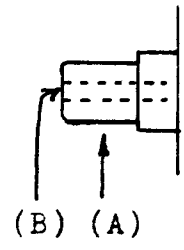
SPADE LUG -- Used to strengthen the connection wherever a wire is to be attached to a screw terminal. "Spade" is inserted around shaft of screw under screwhead, and screw is tightened to clamp it securely.



2 Terminals

RCA (preferred designation) or PHONO PLUG -- Perhaps the single most common audio connector in use. Found on all consumer hifi equipment, carrying both low level (phonograph cartridge, e.g.) and line level (tape recorder, tuner, and so on) signals.
In the diagram, "A" designates the ground (shield) connection, and "B" the signal connection.
Female also appears as a cable connector, in addition to the more common panel-mounted configuration shown here.



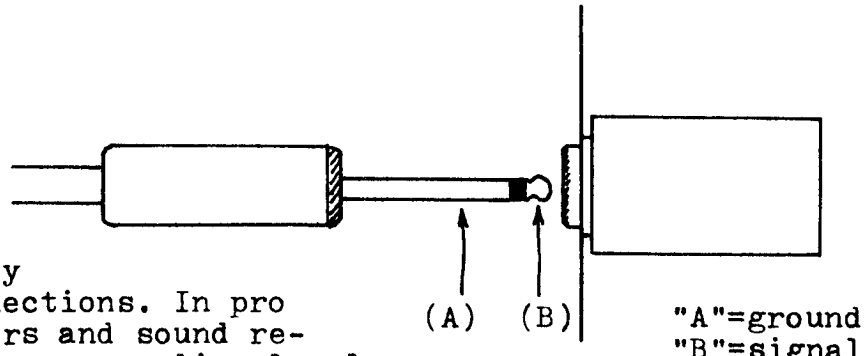


COMMON AUDIO CONNECTORS

(male) (female)

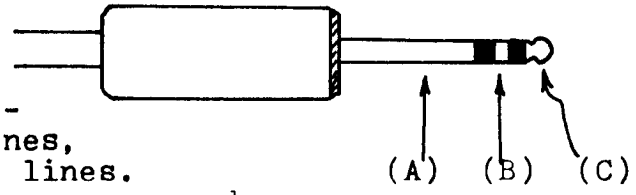
2 Terminals (cont.)

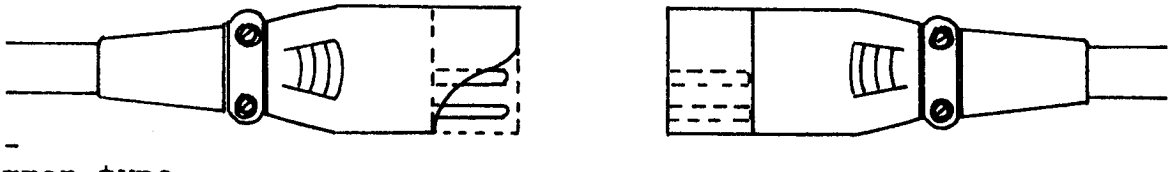
PHONE or ¼ INCH PLUG -- Almost as common as the RCA style connector, this type is generally found in consumer audio equipment only for microphone connections. In pro instrument amplifiers and sound reinforcement gear, may carry line level. Also found in two smaller sizes: MINI PHONE, found largely on small cassette recorders or radios as headphone connection, or in video equipment used for line level audio; also used increasingly for synthesizers. SUBMINI PHONE, rare on good audio gear.



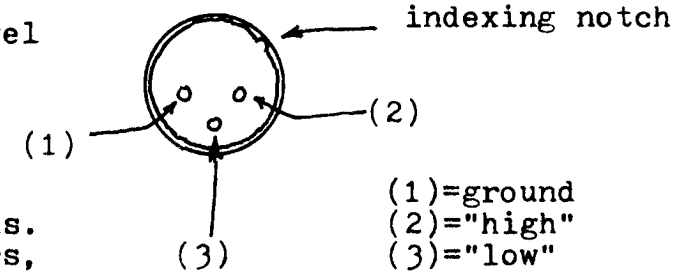
3 Terminals

STEREO PHONE -- used primarily in connecting stereo headphones, rarely for balanced lines. Female has same appearance as above. In stereo headphone connections, "A" is ground, "B" is right, "C" is left.





CANNON XLR-3 -- A very common type in semipro and pro gear, this connector may carry low level (e.g. microphone) or line level signals. In either case, its use generally indicates a balanced transmission line. The male, above, is a cutaway view to expose positioning of the pins. Pins are designated by numbers, as at right (numbers given are for male, seen end-on). Different wiring systems are used -- check data on individual equipment.



CREATIVE SOUND
SELECTED BIBLIOGRAPHY

	H. REF.	S. REF.	AWARE.	THEORY	PRACT.	HISTORY	TEXT	GUIDE
Alkin, Glyn: TV Sound Operations. Hasting House Publishers, N.Y., N.Y., 1975. A comprehensive and accurate treatment of the subject by a professional in the field (BBC).				X	X		X	X
Appleton, Jon H., and Perera, Ronald C., ed.'s: The Development And Practice Of Electronic Music. Prentice-Hall, Inc., Englewood Cliffs, N.J., 1975. An up-to-date collection of historical/ critical essays principally of interest to the musician or listener with an interest in electronic music. Good bibliography and discography.			X			X	X	X
Athey, S.W.: Magnetic Tape Recording. N.A.S.A., Washington, D.C., 1966. (NASA SP-5038) A comprehensive survey of tape recording procedures and hardware, including analog, digital, FM, and instrumentation recording.	X			X				X
Benade, A.H.: Horns, Strings, and Harmony. Doubleday Anchor Books, Garden City, N.J., 1960. Readable and accurate, this text is a recommended reference in acoustics.		X		X			X	X
Deutsch, Herbert A.: Synthesis: An Introduction To The History, Theory, And Practice Of Electronic Music. Alfred Publishing Co., Inc., 1976. Includes a basic discussion of the history and theory, good coverage of the tape recorder and synthesizer by a man who participated in the development of the Moog Synthesizer. Exercises are given, and a record of sample techniques (33 1/3 rpm) is included.	X		X	X	X	X	X	X

	H. REF.	S. REF.	AWARE.	THEORY	PRACT.	HISTORY	TEXT	GUIDE
Dolan, Robert E.: Music In Modern Media. G. Schirmer, Inc., N.Y., N.Y., 1967. A classic, dealing with recording setups and techniques, studio control-room procedures, film sound track composing and recording, TV production, even electronic music. Slightly dated, but a standard reference nonetheless.	X	X		X	X		X	X
Dwyer, Terence: Making Electronic Music. Oxford University Press, London, England, 1975. An excellent, recommended text for a First Studio, suitable for a wide range of ages (although illustrations appear to show Jr. H.S.-age students). Many ingenious, creative techniques are explained clearly and simply, and all require an absolute minimum of equipment. Cleverly lays the groundwork for later use of more sophisticated studios.	X		X	X	X		X	X
Eargle, John: Sound Recording. R-e/p Books, Hollywood, Ca. "The best book on the technical side of recording... thoroughly recommended." (Studio Sound) Highly technical, for the advanced student of the art or the working pro. Deals with sophisticated equipment and theory.	X	X		X	X		X	X
Everest, F. Alton: Handbook of Multichannel Recording. R-e/p Books, Hollywood, Ca. A Classic, comprehensive reference. The comments re Eargle apply to this text as well. Also available from High Fidelity Music Listeners' Book Service.	X	X		X	X		X	X
Everest, F. Alton: Setting Up And Using A Multichannel Recording Studio. TAB Books, Blue Ridge Summit, Pa., 1975. A practical reference described by its title. Useful when you get to the semi-pro level (recommended by TEAC in manuals supplied with their multichannel mixers).	X			X	X		X	X

	H. REF.	S. REF.	AWARE.	THEORY	PRACT.	HISTORY	TEXT	GUIDE
Friend, David, et. al.: Learning Music With Synthesizers. Hal Leonard Publishing Corp., 1974.	X			X	X		X	X
Clearly of use primarily in music education. Written specifically for use with ARP synthesizers; basics are nonetheless accurate, and the book will be very useful if you have an ARP or can tolerate "translating" for the synthesizer you do have. Extensive technical details.								
Goudket, Michael: An Audiovisual Primer. Teachers College Press, Columbia University, N.Y., N.Y., 1974.	X			X	X			X
A good, readable introduction to the making and presentation of AV materials for instructional use. Includes valuable practical information on the care and feeding of equipment, and on presentation.								
Jenkins, John, and Smith, Jon: Electric Music: A Practical Manual. Indiana University Press, Bloomington, Ind., 1976.	X			X	X			X
A well written, clear manual specifically dealing with the many problems of electric music performance. Useful to Creative Sound programs in terms of presentation, and in its introduction to some of the many inexpensive modifier boxes made for the Pop musician. Foreword by R.A. Moog.								
Kock, W.E.: Sound Waves And Light Waves. Anchor Books, Garden City, N.J., 1965.	X	X		X			X	X
This accessible text integrates acoustics and optics, and includes unusual information on acoustic lenses, illustrated photographically with a method which gives the reader a rare opportunity to see sound as it undergoes reflection and focusing.								
Lipton, L.: Independent Filmaking. Straight Arrow Books, San Francisco, Ca., 1973.	X	X		X	X		X	X
A most important text on the subject, containing an excellent chapter on recording.								

	H. REF.	S. REF.	AWARE.	THEORY	PRACT.	HISTORY	TEXT	GUIDE
Murray, Don: The World Of Sound Recording. J.B. Lippincott Co., N.Y., N.Y., 1965. This is a very readable, anecdotal history of sound recording technology and applications, containing many ideas for creative uses in a broader range of areas than is covered by most other texts in this bibliography. While a bit dated, it is well written, and the author is clearly an enthusiast. A recommended source/textbook for Creative Sound.			X	X	X	X	X	X
Pincus, E.: Guide To Filmaking. Signet Books, N.A.L., N.Y., 1969. Comments re Lipton, above, apply.	X			X	X		X	X
Runstein, Robert E.: Modern Recording Techniques. Howard W. Sams Co., Inc., Indianapolis, Ind. Recommended by a number of sources, this volume is in use as a text in the seminars offered by the Recording Institute of America. Again, more useful at the semi-pro level.	X	X		X	X		X	X
Schafer, R. Murray: The New Soundscape. Clark and Cruickshank, Toronto, Canada, 1969. A "handbook for the modern music teacher," this readable and interesting volume offers some ear- and consciousness-expanding material useful to the teacher and student of Creative Sound, as well. Written by a recognized artist in electronic music, in response to his teaching experiences.			X			X	X	X
Sear, Walter: The New World Of Electronic Music. Alfred Publishing Co., Inc., Port Washington, N.Y., 1972. Good basic discussions of acoustics, electricity, magnetism, recording, synthesizer principles. No unnecessary detail is given, and writing is suitable for H.S. level.			X	X	X		X	

	H. REF.	S. REF.	AWARE.	THEORY	PRACT.	HISTORY	TEXT	GUIDE
Strange, A.: Electronic Music Systems, Techniques, And Controls. W.C. Brown Co., Dubuque, Ia., 1972.	X			X	X	X	X	
This oft-cited, classic text is relatively approachable and useful, despite several technical errors. Again, slanted toward musical applications.								
TEAC Corp.: The White Paper. TEAC Corp. Of America, Montebello, Ca., available through hifi dealers.	X			X	X			X
A 24-page booklet about tape recorder technology. Critical performance parameters are explained for the novice, making this a handy little reference.								
Tremaine, Howard M.: The Audio Cyclopedia. Howard W. Sams and Co., Indianapolis, Ind., 1969.		X		X				X
The classic, standard reference. A must for comprehension of the more technical of the sources here listed, and always handy.								
William, Fred: Electronic Music For Young People. Center For Applied Research In Education, Inc., N.Y., N.Y., 1974.			X			X	X	
Best suited for elementary school use, this "awareness" text offers the student comparisons between electronic music compositions and contemporary art, and includes some exercises that can be interest-generating and use equipment found in most schools.								
Woram, John M.: The Recording Studio Handbook. Available through Modern Recording Magazine, Port Washington, N.Y.	X	X		X	X			
An up-to-date, high level reference for the more sophisticated studio, written by a pro (former Eastern V.P. of the Audio Engineering Society, engineer for RCA and Vanguard). Hefty and expensive.								

PERIODICALS:

The technical aspects of sound recording advance quite rapidly, and the contact with the field that is necessary if one is to stay abreast of new developments can only be maintained through periodical literature. Following is a selected list:

Audio (high fidelity orientation)
Audio Engineering Society Journal (excellent, right at the forefront, but highly technical; good occasional library reading)
The Audio Amateur (approachable, some do-it-yourself)
db, The Sound Engineering Magazine (studio procedures, high tech)
High Fidelity (orientation obvious from the name; often good articles)
Popular Electronics (broad range of information, do-it-yourself, theoretical articles)
Radio-Electronics (same comments as above, preferred by this author)
Recording Engineer/Producer (studio procedures, high tech)
Modern Recording Magazine (this author's current favorite; studio procedures, live recording and sound reinforcement, semi-pro as well as pro coverage)
Studio Sound (from London, some do-it-yourself, sometimes highly technical)

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Categorization Abbreviations:

H. REF. denotes "handbook" references.
S. REF. denotes "standard" references (i.e. to be referred to for definitions and clarification of questions).
AWARE. denotes those texts promoting expansion of sound awareness.
PRACT. denotes those texts suitable for use in practicum.
TEXT denotes those suitable as textbooks.
GUIDE denotes those suitable as reference guides for instructors.

MISCELLANEOUS INSPIRATIONS

Following is an incomplete and thoroughly personal listing of a few books and recordings found by the author to have been helpful in the understanding and development of a creative approach to sound:

Books

Cage, John: Notations. Something Else Press, N.Y., N.Y., 1969.

Silence. Wesleyan University Press, Middletown, Conn., 1961.

A Year From Monday. Wesleyan University Press, 1969.

Malina, Frank J., ed.: Kinetic Art: Theory And Practice. Dover Publications, N.Y., N.Y., 1974.

Tomkins, Calvin: The Bride And The Bachelors. Viking Press, N.Y., N.Y., 1965.

Reck, David: Music Of The Whole Earth. Charles Scribner's Sons, N.Y., N.Y., 1977.

Various authors: On The Future Of Art. Viking Press, N.Y., N.Y., 1970.

Recordings

Columbia:

MS 7207 "The World Of Harry Partch"

MS 7051 "New Electronic Music..." (Music of Our Time series)

MS 6146 "Music of Edgar Varese"

MS 7222 "Conlon Nancarrow: Studies For Player Piano"

Deutsche Grammophon Gesellschaft:

139421/22 "Hymnen" (K. Stockhausen)

138811 "Stockhausen: Electronic Music"

Nonesuch:

H-71246 "Iannis Xenakis: Electroacoustic Music"

Limelight:

LS-86049 "Pierre Henry: Le Voyage"

Earthquack:

EQ0001 "Mother Mallard's Portable Masterpiece Company"

EQ 0002 "Like A Duck To Water"