N

NAB: National Association of Broadcasters. A body involved in the specification and development of technical standards in the U.S. audio and broadcasting industry.

NAB characteristic: The *pre-emphasis* and *de-emphasis* equalization standard for magnetic tape recording adopted in the U.S. and Japan.

NAB spool: The 10" metal tape spools used on professional tape recorders.

Nagra: A Swiss brand of professional recorder originally designed to record on-location synchronous sound for motion pictures, the industry standard for thirty years, owing to the quality and ruggedness of the recorders. It uses ¼" tape and is generally equipped with a *crystal sync* generator. Originally Nagras were portable, designed for used while being carried, and are equal in quality to high-end studio recorders. There are now various models and track formats, including some made just for studio use for making *transfers*, film mixes, etc. Nagra makes both digital and analog recorders, mono and stereo; use of a stereo Nagra on-location is almost always to record two separate mono tracks simultaneously, and does not usually mean a stereophonic recording. Nagra means "recorded" in Polish, founder Stefan Kudelski's native language, and the recorders are manufactured by Kudelski S.A. See *neo-pilot*.

Nagra-D: The digital version of the *Nagra* recorder, using ¼" tape to record up to four tracks of 20-bit audio.

Nagramaster: An *equalization curve* developed for use by Nagra recorders that uses an HF boost during recording and de-emphasis during playback to increase the *SNR* at 15ips.

NAMM: National Association of Music Merchants. A trade association of musical instrument retailers.

nano: Prefix meaning, "one billionth of the quantity that follows."

nanoweber: A unit of magnetic *flux*, one-billionth of a *weber*. On recording tape, specific or reference *flux density* is measured in nanowebers per meter.

narrowband: A relatively short frequency span, defining a signal or filter which encompasses a small spectrum bandwidth, as opposed to *wideband* or *broadband*. Filters sharper than one-third *octave* are generally considered narrowband filters.

natural: A symbol (♮) which is used to cancel the effect of a *sharp* or a *flat*.

natural frequency: See *resonance*.

NC Curve, NC Contour: Noise Criterion. The *ambient* or background noise in an auditorium or room. See *walla, ambience, room tone*.

**N-Curve**: Same as *Academy curve*. See *X-Curve*.

N

near-coincident pair: A *spaced-pair* microphone technique which uses *directional* micro-phones, placed approximately 7" apart, or the average spacing between ears on a human head. This allows for some amount of phase difference in the two signals, but not enough to lose mono compatibility, combining the level difference recording characteristics of direc-tional *coincident-pair* microphones in a spaced array. *ORTF* is the most common near-coincident arrangement, but others include *NOS*, and the *Faulkner array*.

near-field: The sound field very close to a sound source is called the near-field. By "very close" is meant less than one *wavelength* at the frequency of interest. A near-field speaker is a compact studio *monitor* designed for listening at close distances (3'-5') so, in theory, the ef-fects of poor room acoustics are greatly reduced. See also *far-field, reverberant field.*

needle-drop: Any single section of music, no matter how short, copied from a music library for use in a film or video soundtrack, or a commercial spot. The producer or client must pay the specified fee to the library or copyright owner for each needle-drop, even when the same section is used more than once in the production.

negative feedback: See *feedback.*

neo-pilot: A system for the synchronization of a motion picture camera with a $\frac{1}{4}$" tape re-corder recording the sound, using a superimposed *crystal sync pilot tone* generated by the camera or an oscillator, usually at 50Hz or 60Hz, on the *full-track* tape in such a way that it is not sensed by the normal full-track playback head, and so is not heard with the recorded sounds. The recovered signal is used to control the speed of the tape recorded in playback so the sound remains in sync with the picture. This process is called *resolving.* Developed for use in analog, mono *Nagra* recorders.
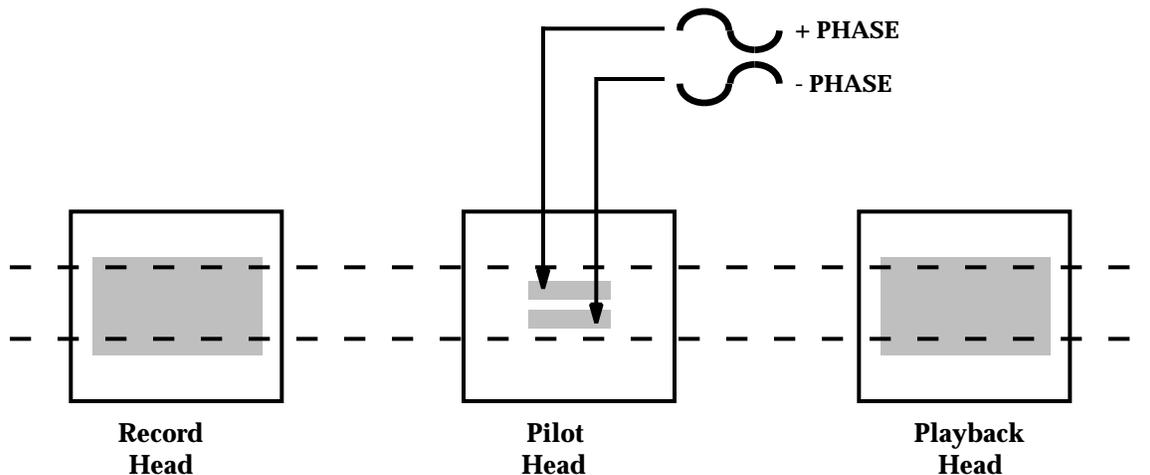
Neo-Pilot Tone

The *sync head* records two thin tracks of *sync tone* near the center of the tape. These thin tracks are read by the resolving circuits that control the motor speed of the player to maintain correct synchronization. As the sync signals are in *antiphase*, when both tracks pass the play-back head simultaneously, they are *phase-cancelled.*

N

Neutrik: A German company which makes high-quality audio connectors, including the "Speakon" series, a range of very rugged, locking connectors used in larger loudspeakers and amplifiers.

NICAM: Near Instantaneous Companded Audio Multiplex. A television broadcasting standard that allows transmission of digital audio data alongside video, giving improved audio quality and stereo operation.

no: Used politely and defensively, the most powerful word in any language. It can protect one from naïve or unintended commitments of time, money, and emotion. Use liberally until satisfied with the entirety of any proposed deal, production, etc., which has the acceptable terms codified in writing.

node: See *anti-node*.

noise: (1) a sound which contains all of the frequencies in the audible range. (2) An unwanted sound which is not related to the wanted sound; if it is, it is called *distortion*. Noise is comprised of all audio frequencies at constantly varying amplitudes, therefore, it has no definable *pitch* or *timbre*. See *white noise, pink noise, residual noise, ambient noise, quantization noise, modulation noise, NC-Curve, noise floor*.

noise figure: Most simply, the noise figure of an electronic device is the measurement of how much worse the *S/N ratio* is at the output of the device than it was at the input, expressed in dB. The noise figure is usually important only for low signal-level devices, such as a mic preamp, where there is a very low input signal level which approaches the intrinsic *noise floor* of the environment. Also called the *noise factor*, but only if the measurement is expressed as a linear quantity.

noise filter: Either a *narrowband* or *notch filter* used to eliminate pitched noise, or a *broadband* filter used to attenuate the entire high or low frequency range.

noise floor: The noise floor is the *intrinsic* noise of any audio device or other electronic system, generally measured in dBm. Sometimes the noise floor is measured in terms of *RMS* voltage rather than power, and this makes sense in the case of devices such as voltage amplifiers or tape recorders. Includes *Johnson noise* and *flicker noise*. See *quiescent noise*.

To calculate the intrinsic *noise level* of a device, expressed in watts: if one took one 600 resistor on the input of a (noiseless) microphone preamp with a 60dB gain, the output would be about -100dBm. This is the lowest possible noise floor:

$$\textbf{4KTR}_\Omega\textbf{B}_{\textbf{Hz}} \text{ where}$$

K = Boltzman's constant = 1.38×10^{-23}
T = Temperature in Kelvin
R = Resistance in Ohms
B = Bandwidth in Hz

$$10\left[\log\left(4\left(1.38 \times 10^{-23}\right)(298)(600)(20,000)\right)\right] - 30 = -157\textbf{dBm}$$

N

noise gate: A *noise reduction* device through which an audio signal is passed. When the signal level is very small, the noise gate will close, eliminating any residual noise that may be riding on the signal. In the presence of a signal, the noise gate will open, allowing both signal and noise to pass through, as under these conditions, the noise is masked by the signal. A noise gate is a special type of *expander* with an infinite expansion ratio below a preset threshold. The effectiveness is determined by the time constants associated with the gain reduction, and often the background noise can be heard switching on and off with the signal. See *breathing, gate, floor.*

noise generator: A device to generate *white noise* or *pink noise*, a random signal that contains all frequencies at the same time.
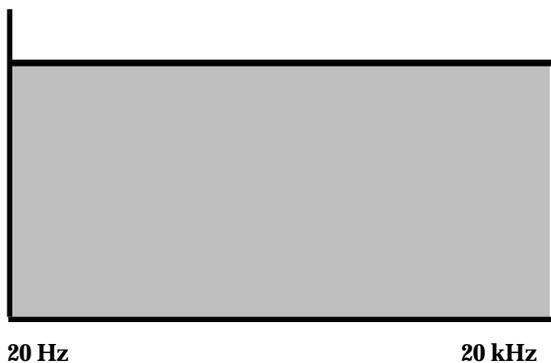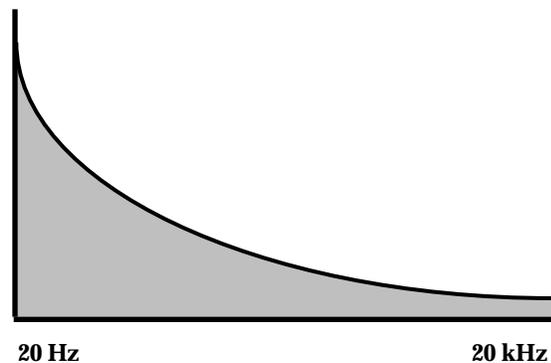
20 Hz 20 kHz	20 Hz 20 kHz
White Noise	**Pink Noise**

noise level: (1) The *noise floor* of an electronic device. (2) The steady-state decibel level of *ambient noise* in an acoustical environment. See *NC Curve.* (3) The *residual noise* of a magnetic tape.

noise modulation: See *dither.*

noise pumping: See *breathing, noise gate.*

noise reduction (NR): Two technologies for noise reduction have become standard in the consumer and professional recording industry: *dbx* and *Dolby*. All *two-ended* noise reduction systems are a type of *compander*, i.e., they operate by encoding the signal at the record end, and decoding the signal, restoring the *dynamic range* and frequency spectrum, upon playback.

Type	Application	CR*	S/N**	Headroom	Emphasis	Split-Band	Range
dbx-I	open-reel	2:1	30dB	+10dB	12dB	No	Linear
dbx-II	cassette	2:1	30dB	+10dB	12dB	No	Linear
Dolby-A	open-reel	< 9kHz <10dB				4 fixed	-10VU
		< 15kHz <15dB					
Dolby-B	cassette	> 4kHz <10dB			(mod. Dolby-A)	No	HF
Dolby-C	cassette	> 1kHz <20dB			(mod. Dolby-A)	No	HF
Dolby-HX	cassette	(adds control of recording bias and equalization by the HF component of the signal)					
Dolby-S	cassette	> HF <24dB			(mod. Dolby-SR)	3 fixed,	HF, LF
		< 1kHz <10dB				2 sliding	
Dolby-SR	open-reel	> 25dB				5 fixed,	All
						5 sliding	

*CR is an abbreviation for compression ratio. **S/N means improvement of S/N, in dB.

Single-ended noise reduction systems need no encoding or decoding. The NR is applied to noisy instruments or microphones and works either by *dynamic filtering* or *downward expansion*. Dynamic filtering works will with noisy synthesizer sounds, but can cause *pumping* and *breathing*. A downward expander attenuates any signal below the threshold. It works when applied to cut the buzz on a noisy guitar amplifier, but it can also cut off quiet signals like reverb tails if the threshold is set too high. See *dynamic filter*, *spectral recording*.

noise shaping: Signal processing used in *DAC*s to shift the frequency of noise in a digital signal so that, on conversion, the noise will be outside (usually above) the audio range. This is done by reducing the number of *parallel* bits used to carry the data, increasing the number of *serial* bits and so the frequency of the digital signal. In oversampling digital systems, digital filtering is used to reduce *quantization error*. By changing the shape of the *spectrum* of the *quantization noise*, increasing its high-frequency content by lowering its low-frequency content, an *anti-imaging filter* can then be used to reduce the increased high-frequency noise. See *dither*.

nominal level: The optimum level at which a signal is processed in a particular piece of audio equipment. For instance, if the unit has a VU meter, this level would be represented by the 0VU mark, past which the meter goes into the red. Normally expressed in dBV for professional recording equipment, the two output levels are commonly called *mic-level* and *line-level*. Also called *output level*.

nonlinear distortion: *Linearity* would predict an invariant ratio of gain to input voltage in an audio device such as an amplifier. Manifested as *harmonic distortion* and *intermodulation distortion*, there is a point at which the amplifier gain is reduced as the input gain is increased. This is the nonlinear region of the amplifier. All audio devices have local peculiarities or deviations from linearity at specific signal levels. See also *distortion*, *linear distortion*.

N

nonlinear recording: Use of a recording medium which is random access, i.e., not recorded to conventional tape. Digital recording systems allow for playback in any order, while linear systems require that playback occur in the order in which the material was recorded.

NoNoise: Sonic Solutions' digital signal processing system that analyzes the digitized signal and senses transient noises, such as clicks and pops, and continuous noises, such as tape *hiss* and AC *hum*. It removes the transients and makes a substitute signal by interpolation. Used to restore old recordings. A competitive program is called *CEDAR*, developed at Cambridge.

non-real-time: (1) The situation where events can occur at any time, independently of other events and without the need for human input or synchronization. See *real-time*. (2) See *Universal System-Exclusive*.

normalize: To boost the highest level of a *waveform* or *sample* in a digital system to 0dB and then raising all other samples by the same proportion. This maximizes resolution and minimizes certain types of *noise*.

normalled connection: A connection, typically on a mixer or patch panel, where the signal path is continuous in the absence of a plug inserted into the signal *chain*. Usually normalled connections are made via *TRS* jacks. In a solidly grounded system, inserting a stereo plug half-way into the jack, where the tip makes a connection, but not the ring, would yield an additional channel output, as opposed to a *channel insert*. In a poorly grounded system, this yields *hum*. See also *breakjack*. Called *normalized* connections in the UK. (*verb*) Normalling.

normal stereo: See *coincident pair*.

norvalizing: Film slang for playing a sound effect at a low level in an attempt to hide the fact that it is not in sync with the picture.

NOS: See *ORTF*.

notch filter: See *band-reject filter*.

note-doubling: An (undesirable) effect caused by a *MIDI loop*, i.e., when data fed to a sequencer's MIDI In appearing at the MIDI Out to be fed back into the keyboard. This sounds like *flanging*, and cuts the *polyphony* of the synthesizer in half.

note number: The value which appears in the first data byte of a MIDI Note On or Note Off message. It determines which note will be turned on or off. 128 notes (more than 10 *octaves*) can be described, with note number 60 being middle-C.

Note Off: A Channel Voice message which causes a device to stop playing the note defined in the message. True Note Offs are seldom used, except on those devices that implement release velocity sensing, the preferred method being to send a Note On with zero velocity. This allows the use of *Running Status*, reducing the amount of data transmitted.

Note On: A Channel Voice message which causes a device to sound the note defined in the message. See *Note Off*.

**NR**: See *noise reduction*.

N

N.T.S.C.: National Television Standards Committee. (1) The American group which defines the format of U.S. color television. (2) The standard this organization has developed for color television transmission, also known as Never The Same Color. See *frame*.

null clock: The *word clock* data imbedded in an audio signal. For example, all *AES/EBU* digital audio signals carry word clock data, but if this clock information is passed without any actual digital audio, the signal is known as "null clock."

null-**point**: In the *update mode* of mixing console *automation*, the positions at which all the faders are set at the beginning of an update pass through the mix.

nut: The slotted plastic piece at the headstock end of a guitar neck which is used to guide the strings over the fingerboard, and to space the strings above the frets.

Nyquist frequency: The highest frequency that can be reproduced accurately when a signal is digitally encoded at a given *sampling rate*. Theoretically, the Nyquist frequency is half the sampling rate. For example, when a digital recording uses a sampling rate of 11kHz, the Nyquist frequency is 5.5kHz. Conversely, if one wishes to produce an audio bandwidth of 20kHz, a sampling rates of 44.1kHz is used as the brick-wall filter on the A/D converter starts to roll-off at 20kHz so that the level has dropped to zero at the Nyquist frequency of 22..05kHz, yielding full level throughout the 20kHz AF band. If a signal being sampled contains frequency components that are above the Nyquist limit, *aliasing* will be introduced in the digital representation of the signal unless those frequencies are filtered out prior to digital encoding by means of an *anti-aliasing filter*. The Nyquist Theorem is also called the *Sampling Theorem*. **See** *brick-wall filter*.
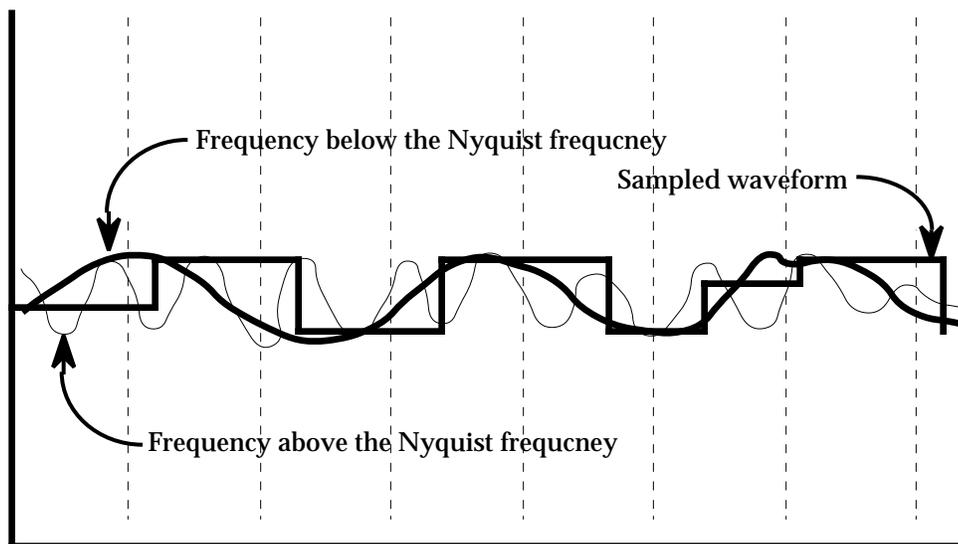
How frequencies higher than the Nyquist frequency create aliased frequencies in the audible range: the sampled waveform is identical to the period of the waveform below the Nyquist frequency due to the way the sampling clock rate intersects the waveforms.