R

rack: A type of shelving, usually with enclosed sides and back, to which audio components can be attached vertically, one on top of the other. Components are normally screwed into front-mounted, tapped metal strips with holes which are spaced so as to accommodate the height of devices of various *U*-sizes. Racks are usually 19" wide and have their height denominated in U-units.

radiation impedance: The acoustic *impedance* that acts as a load on a loudspeaker, opposing the motion of the cone.

radiation pattern: (1) The *polar pattern* that graphs a loudspeaker's directional characteristics for a group of specific test frequencies. (2) The three-dimensional graph of the intensity with which any sound source emits various frequencies at all angles around itself.

radio frequency (RF): An *alternating current* or *voltage* having a frequency above about 100kHz, so-called because these frequencies are radiated as electromagnetic waves by radio and television, and as high as 30GHz (30,000 MHz). The constant frequency of the *carrier* wave (the frequency which you tune into) falls within this range. This is then *modulated* by the audio (or other) signal, according to some process such as *AM* or *FM.*

radio microphone: A mic with a built-in RF transmitter used instead of a cable connection to give a performer increased mobility. A receiver system picks up the transmitted signal for distribution to a PA, etc.

ramp wave: See *sawtooth wave.*

random access: Storage systems where data may be stored and accessed in any order, independent of the ordinal position of the data when it was originally recorded. This is the opposite of *linear*(3) access, or linear recording media such as magnetic tape which necessarily preserves the sequential relation of the data as it is recorded, and depends on this sequential relation for accurate playback. See *non-linear recording.*

random noise: Sound where there is no predictable relationship between the frequency or amplitude of the waveform over time. See *white noise*, *pink noise.*

R

rarefaction: The spreading apart of air molecules which lowers the local air pressure, during the second half of each complete cycle of a sound wave. This corresponds to the portion of the wave that appears below the x-axis when graphed. The opposite of *compression*.
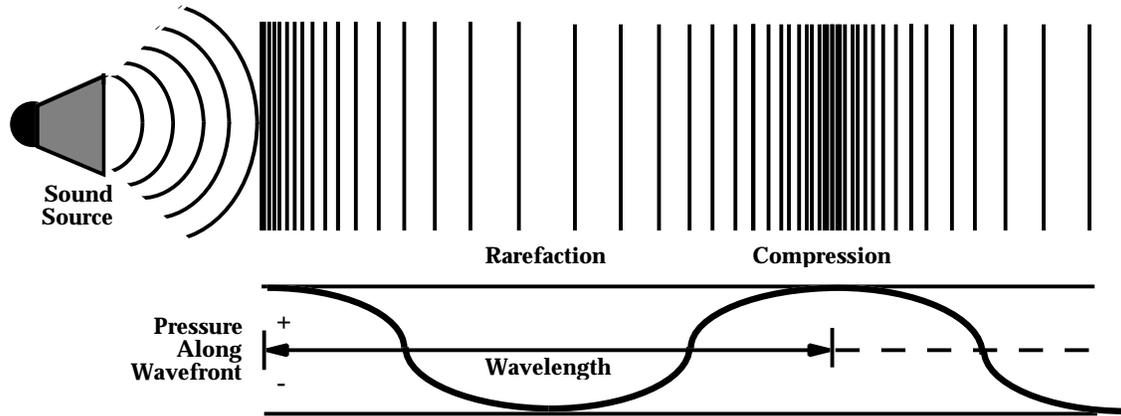
Rarefaction and Compression of a Sound Wave

raster: The characteristic patterns of horizontal lines formed by the scanning beam of the TV picture tube. Also, the actual electronic circuit that creates the scanning spot that traces these *lines* on the TV screen.

rate: In a digital *delay* or *flanger*, a circuit and control that enable varying of the length of time during which the *depth* circuit completes one full increase or decrease cycle of the nominal delay time. To the ear, the rate control varies the speed of the apparent *vibrato* added to the input signal by the depth circuitry.

rate control: An *envelope* parameter which controls the rate or timing of certain synthesizer actions, such as the attack, decay and release portions of an *ADSR* envelope. Compare with *level control*.

rated bandwidth: The frequency range, normally 20Hz-2kHz, over which the performance of an audio device is rated with respect to specification characteristics such as *power output bandwidth*, *harmonic distortion*, etc.

rated load: The load *impedance* into which a power amplifier or loudspeaker is designed to operate safely, and upon which other rated characteristics are based. See *power bandwidth*.

RCA connector: See *phono connector*.

RCH:

R

R-DAT: Rotary-head Digital Audio Tape: A standard for digital audio tape recording which employs a rotating head mechanism similar to that of video recorders. Two channels of 16-bit digital audio information, plus *subcode* and track information, can be recorded onto a tape approximately 3mm wide, traveling at a very low speed of about 50 cpm. The tape is housed in a case similar to a video cassette, though much smaller. R-DAT machines offer three sampling rates: 32kHz, 44.1kHz, and 48kHz. Maximum continuous record time for a cassette is two hours at standard play and four hours at long play, with reduced quality. See also *DAT*.

reach: The clear pick-up of quiet, distant sounds by a microphone due to a high *S/N ratio*. See *self-noise*. The higher the *SPL* of the sound source at the mic, the higher the S/N ratio. Given an SPL of 94dB, a S/N spec of 74dB is excellent, 64dB is good. The higher the S/N ratio, the cleaner (more noise-free) is the signal, and the greater the reach of the microphone.

reactance: The complex component of *impedance*.

read: The quality of a sound in the context of its placement within a film, theater, or other audio situation is described as how the sound "reads." See *popcorn noise*.

read mode: In console *automation*, the operational mode in which automation data concerning the fader level or other parameter for each channel is read back from data storage and used to reproduce those settings in *real-time*, actually controlling each parameter exactly as it was done on the recording pass.

ready: An operational mode of tape recorder electronics. For any tracks placed in ready mode, the record circuits are enabled. When the master record button is pushed and the tape begins moving, the ready tracks begin recording. The opposite of *safe* mode.

RealAudio (.RA): RealAudio files use a proprietary format designed specifically for playing audio-on-demand in real-time over the internet, introduced by Progressive Networks in 1995, consisting of a server application, and encoder, and a player which works within a Web browser. Normally, the RealAudio player delivers 16-bit sound, although an 8-bit option is available. Data rates range from 14.4kBps (approximately the sound quality of a mono AM station) to dual ISDN Stereo at 16kHz, nearly CD-quality. See *RTSP*.

real-time: Occurring at the same time as other, usually human, activities. In real-time sequence recording, timing information is encoded along with the note data by analyzing the timing of the input. In real-time editing, changes in parameter settings can be heard immediately, without the need to play a new note or wait for computational processes to be completed. (1) The ability of a computer or other device to carry out a process without noticeable delay, such as real-time editing on a sequencer where changes are made to the music as it plays. The opposite of *off-line*(1). (2) In a sequencer, the ability to record MIDI messages as they are played on a keyboard or other controller, i.e., to behave like a tape recorder. This is generally the method preferred by musicians. The opposite of *step-time*. (3) Events which have to occur at particular times to ensure synchronization between devices such as a timecode message, as opposed to those (non-real-time) events which can occur at any time. (4) See *System-Exclusive*.

Real-Time Analysis: See *RTA*.

R

real-time control: A non-preprogrammed control signal generated by the player via a *control-ler* such as a *pitch-bend* **wheel**, *mod wheel*, *aftertouch* (pressure) **sensor, footpedals, etc. It is common to have one of these real-time controllers affecting the depth (amount) of modulation signal being sent from some other (nonreal-time) source to the modulation destination. See** *continuous controller.*

real-time dubbing: Duplicating a tape at its normal playing speed rather than at a higher speed, resulting in better quality than high-speed dubbing.

real-time input: MIDI input generated in *real-time,* such as during a performance or studio recording session. See *real-time control.*

Real-Time MTC Cueing: MIDI messages similar to Set-Up which contain information such as *cue points, punch-in/-out points,* **event start and stop points, and event names. Unlike conventional** *MTC* Set-Up messages which include details of the absolute times in the future at which events should occur, Real Time MTC Cueing messages are of the Universal System-Exclusive Real-Time type and so are to be acted on when received.

reassign: An output bus designed for internal re-routing and combining within a mixing console. See *insert point.*

recapitulation: In a musical structure, the final return to the theme from the main opening section, usually modified to occur in the home *key.*

reception mode: See *MIDI mode.*

reclock: To align bars and beats in a digital editor to music recorded without a tempo reference.

reconstruction filter: In a digital audio system, in order to recover the analog signal from the digital words, a *D/A converter* **is used. The output of the converter is a stair-step waveform which contains a great deal of high-frequency artifacts called** *images.* **To reconstruct a smooth replica of the original signal, the stair-step is passed through a steep** *lowpass* **filter, also called an** *anti-imaging filter.* **It is similar, or even identical, to the** *anti-aliasing filter* **at the input of the** *A/D converter,* **but its purpose is very different. Also called an** *anti-imaging filter.* **See** *quantization,* **decimation,** *FIR, IIR.*

record-equalization: Also the same for *playback-equalization.* **In tape recording, the internal and** *complementary* **alteration of the** *frequency response* **of input signals prior to recording and output signals after playback. By boosting highs prior to recording and reducing them after playback, some tape noise is eliminated. In addition, the equalization curve can compensate for nonlinear response of the specific type of recording tape in use. There are a number of standard record/playback curves. See also** *pre-emphasis, RIAA.*

record head: The *head* **on a tape recorder that applies a varying magnetic force to the tape so that the audio signal will be recorded on the tape for later playback. A very high-frequency signal is mixed with the audio program before it reaches the record head. This** *bias* **signal helps to linearize the over-all** *frequency response* **of the tape itself, reducing distortion.**

R

record-in/record-out: In *SMPTE timecode* synchronization for videotape post-production, the user-specified SMPTE timecode addresses at which the synchronizer will automatically place the audio or video recorder in record mode (*punch-in*) and subsequently cancel the record mode (*punch-out*). See *pre-roll*, *post-roll*, *mark-in/mark-out*.

recordist: (1) The person who operates the recording device during a recording session, or in film, the person who is in charge of aligning and loading the recorders and playback *dubbers*. (2) The person who records sound during film shooting (Europe). In the U.S., this person is called the *production mixer*.

rectifier: A device for converting *AC* to *DC*. Rectification is done through a network of *diodes* in a power supply to convert power line voltage to DC to power *active* devices. Rectification is also used to recover the signal in an *amplitude modulated* wave form.

Red Book: Published by Philips and Sony to set out the complete standard for audio *CD*s so that all CD players will be compatible: uncompressed, 16-bit, 44kHz audio data. The *Yellow Book* publishes standards loose enough to allow computer manufacturers to make CD-ROM players, thus all CD-ROMs are not compatible with all players.

reduction: (1) The mixing of a number of tracks of a multitrack recording to produce a *mono* or *stereo* master, also called *mixdown*. (2) In music, an arrangement of a *full score* for performance by a smaller group of instruments or, more typically, just for piano.

redundancy: The digital transmission of more bits than strictly necessary in order to improve the reliability of the transmission, such as ECC encoding. See *error correction*.

reel motor: In a tape recorder, the motor that controls the motion of either the *feed* and/or *take-up reels*.

reel size control: On a tape transport, the control that maintains proper tape tension by accommodating for various sized feed and/or take-up reels which have different amounts of angular momentum. Newer machines use an infrared or other beam to automatically measure and set the tensions for the various reel sizes.

reference frequency: See *line-up tone*.

reference level: (1) The reference level on an audio device is a signal level near the maximum possible for the device but low enough to ensure low *distortion*. (2) The reference level of a *power ratio* is the unit of power (i.e., watts or volts) being compared. See *decibel*.

reference source: The *clock* signal used to determine the rate at which a *timecode* generator and synchronizer will run; the *master clock* generator. The reference source can be thought of as the system master clock. The reference source can be an internal *crystal sync*, *video sync*, AC power *pulse*, external *pilot tone*, or the timecode reader.

reference tape: A laboratory-recorded test tape which contains a series of *line-up tones* all recorded at a known, standard level or *fluxivity*. The tape is used to verify the performance of the recorder's playback system. Once this is done, the record system is adjusted to produce a signal that, when played back on the playback system, are identical to the input signal. Also called a *test tape*.

reference tone: See *line-up tone*.

R

reflections: Sounds that do not take a direct route to a person's ears, but which bounce first off of a stage, balcony, wall, or other non-absorptive boundary before arriving at the ears. The combined audio effect of all of the reflections of a sound is called *reverberation*. Early reflections are the first reflections to reach the ears and sometimes sound distinct, like little echoes. Closer instruments will generally have a longer delay between the initial *dry* signal and the first early reflections. See also *ESS*.

refraction: The splitting-up of a complex sound wave into separate frequency *bands* as the original wave passes from one elastic medium into another, e.g., from air into water. Similarly, a prism disperses white light into the familiar rainbow of colors, bending the shortest wavelengths (violet) the least, and longest (red) most. See *diffraction*.

regenerating timecode: In copying a video or audio tape with *SMPTE timecode*, the process of reading the code from the master tape and creating a perfect electronic duplicate of it for recording on the copy. The new code is created by a separate device and is necessary to ensure that the audio or video copy is free of timing errors and *dropouts*.

regeneration: (1) See *feedback* and *resonance*. (2) See *timecode regeneration*.

register: A specific part of the *pitch* range of an instrument, voice, or melody, e.g., a cello in its *tenor* register. See also *tessitura*.

Registered Parameter Number (RPN): An extension to MIDI which allows for additional Control Change messages. RPNs have a Control Change number of 100 (LSB) and 101 (MSB). These are defined in the following way:

Registered Parameter Numbers

MSB (CC 101)	LSB (CC 100)	Parameter
00	00	Pitch-bend Sensitivity
00	01	Fine Tuning
00	02	Coarse Tuning
00	03	Tuning Program Select
00	04	Tuning Bank Select

Unregistered Parameter Numbers (NRPNs) are vendor-defined and may vary among systems. NRPNs have a Control Change number of 98 (LSB) and 99 (MSB).

registration: The choice of *stops*, i.e., *timbres*, in organ music.

regroup: The transfer procedure in which material is copied from one medium to another, e.g., from multiple units of *mag film* to a *multitrack*, to facilitate re-recording. For example, a facility might have only five playback dubbers on a *re-recording stage*, and they might transfer twenty units of mag film to 24-track tape in four passes. See also *transfer*.

rehearse mode: In *SMPTE timecode* synchronization for videotape post-production, a synchronizer mode that simulates the engineer-specified operations, including *record-in* and *record-out* commands) at the designated code addresses, but does not actually *punch-in* and *-out*.

reinforcement: An increase in acoustic or electric amplitude that occurs when two or more waves are, to some extent, *phase coherent*. The opposite of *phase cancellation*.

R

relay: An *electromechanical* device, essentially a solenoid-operated switch. Largely superseded by the transistor except in certain high-current applications. One possible such use is in amplifiers where a relay may break the connection to the loudspeakers before very high amplitude sounds can damage the loudspeakers.

re-laying: To *post-stripe* a video master tape, recording the mixed *film soundtrack* back onto the tape after it has been striped for post-dubbing or the addition of narration, music, and/or effects. See *layback recorder.*

relay station: In broadcasting, a remote site with equipment to receive a signal, either through a telephone line (sometimes called a *music line*) or a microwave link, and retransmit it for improved local reception.

release: (1) The portion of an *envelope* that comes after the *sustain* portion and is the amount of time it takes for the sound to go from the sustain level back to silence. The release segment begins after the key is lifted, i.e., the release time to zero-level after a MIDI Note-Off message arrives or the key is released. See *ADSR.* (2) The time it takes for a *compressor's* gain to come back up to normal once the input signal has fallen back below the *threshold.*

release loop: A set of *loop* points that define a portion of the sound to be played repeatedly during an *envelope's* release phase. A release loop starts playing back after a key is released when sample playback will finish the current pass through the *sustain loop* and then move on to the remainder of the sound, which may or may not contain a release loop. The release loop will be heard for the length of time determined by the *release time* parameter setting.

release print: A composite print of a film made for general exhibition purposes. Release prints are generally made using the same exposure, color balance, and effects employed in the final *answer print.* See *internegative, EK neg.*

release time: The length of time it takes for a signal processing device, generally a *compressor, limiter,* or *expander,* to return to its nominal gain-before-*threshold,* once the input signal level no longer meets threshold conditions. See *attack time.*

release velocity: The speed with which a *controller* key is raised or otherwise released, and the type of MIDI data used to encode that speed. Release velocity sensing is rare but found on some instruments. It is usually used as a *rate control* for the *release* segment of the sound *envelope.*

reluctance: The opposition to a magnetic force or field, exhibited by another field and its source, such as an *electromagnet,* or by unmagnetized but potentially magnetic objects such as the oxide domains on *magnetic recording tape.*

remanence: Also called *remanent flux.* The amount of magnetization left on *magnetic recording tape* when an applied magnetic force is removed. Measured in lines of force per quarter-inch of tape width. See *flux density, gauss, hysteresis, residual magnetization.*

R

remote: (1) A recording session which occurs at a location other than a recording studio, such as a concert hall or church, i.e., *on location*. (2) As in a remote control, used to activate a device without using the device's control panel. (3) A device controlled from a distance either through a remote control transmitter or keypad, or by using the controls of another device. For example, playing a remote synthesizer through on a *MIDI network,* or operating certain sync tape machines as remotes by transmitter control.

remote keyboard: A keyboard which can be slung around the neck, like a guitar. It will transmit the performance through a MIDI cable or via a radio/infra-red transmitter matched to an appropriate receiver and MIDI module. Essentially, a type of *MIDI controller.*

repertoire: (1) Music which a soloist or group already knows, i.e., is performance-ready. (2) The catalog of songs or performers that a publishing or record company has signed to it.

replay head: In a tape recorder, an *electromagnetic* device for converting the magnetic patterns previously recorded on tape into a voltage whose amplitude is proportional to the pattern. On some systems, the replay head is also used as a record head, i.e., the replay head is driven rather than listened to, and it may also be used as a *sync head.* The replay head is sometimes called a *repro head.*

repro: One of the operating modes of tape recorder electronics. Tracks placed in repro mode will play the tape via the normal playback head, i.e., not via *sel-sync.* Alternative to *sync mode.*

reproducing characteristic: In audio tape playback, the standardized *equalization curve* introduced by de-emphasis. See *pre-emphasis.*

repro head: See *replay head.*

re-recording: The process of mixing all edited *DME stems,* sync and non-sync, of a film or video production to *mono, stereo, multichannel* or whatever audio format is desired for the final *print master* with the picture, also known as *dubbing.* Usually done at a *re-recording stage.*

re-recording stage: The facility where *re-recording* is done. Contrary to what one might think, there is rarely a stage/platform/dais involved. See *dubbing theater.*

resampling: (1) The process of sampling a previously mixed sample to create a new sample. (2) The changing of a signal encoded at one sampling rate to a different sampling rate via a *re-sampling converter.*

Reset All Controllers: A Channel Voice message which instructs a MIDI device to set all controllers to their inactive condition, effectively doing for controllers what an All Notes Off message does for notes. The message is actually a type of Controller Change message.

residual magnetization: Similar to *remanence,* but generalized to designate the magnetism remaining in any magnetic material once the applied magnetic field is removed.
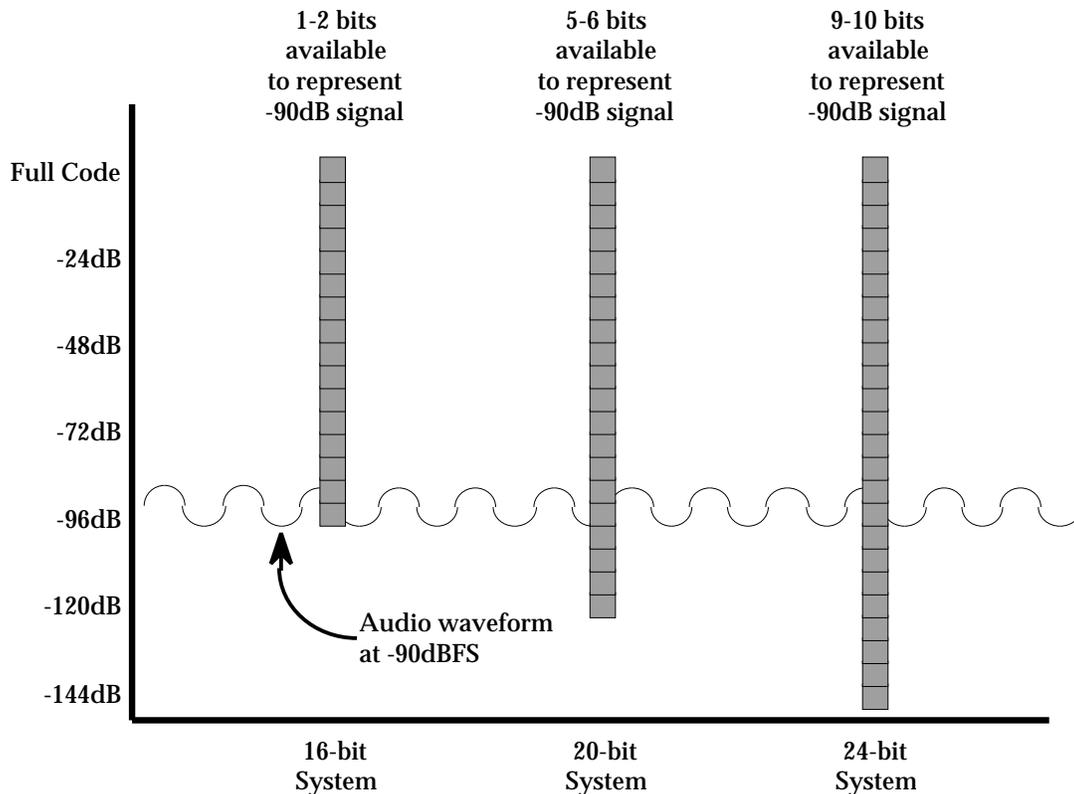
residual noise: The noise that remains on *magnetic recording tape* after full erasure.

resistance: In electrical or electronic *circuits,* a characteristic of a material that opposes the flow of electrons, measured in ohms ( ). Calculated by the formula **R=E/I**, where *E* is the voltage, and *I* is the *current* flow in *amperes,* through the circuit. Resistance results in loss of energy in a circuit dissipated as heat. *Conductance* is the reciprocal of resistance. See *impedance.*

R

resistive network: A *circuit* composed of *resistors*, commonly used in the construction of *attenuators*.

resolution: (1) The fineness of the divisions into which a sensing or encoding system is divided. The higher the resolution, the more accurate the digital representation of the original signal will be. See *bit depth*. In MIDI sequencing, the recording resolution, expressed in *ppq*, measures the timing accuracy with which a device or program can record or reproduce MIDI data. See *sampling rate*. (2) In video, the number of *pixels* which comprise a horizontal *line* of image.

1-2 bits
available
to represent
-90dB signal

5-6 bits
available
to represent
-90dB signal

9-10 bits
available
to represent
-90dB signal

Full Code

-24dB

-48dB

-72dB

-96dB

-120dB

Audio waveform
at -90dBFS

-144dB

16-bit
System

20-bit
System

24-bit
System

Low-Level Signal Resolution as a Function of System Bit-Depth

resolver: (1) (*noun*) The electronic circuit within or connected to a *Nagra* or other synchronous tape recorder that acts as a *servo* to control motor speed on playback to maintain proper synchronization of sound with picture. It keeps the recorded *sync tone* in phase with the 60Hz AC powering the recorder and projector, or can sync the playback with *crystal sync*, or other *reference source*. (2) (*verb*) The process of regulating audio and/or video tape speed by comparing a *reference tone* on the tape with an external *master* and adjusting the speed of the first device so that the two stay in sync is called *resolving*. This can be done striping the tapes with a *pilot tone*, or by a *timecode* such as *SMPTE*. The master deck reads the location from all slave machines and fast-forwards or reverses them until it reads the same timecode from every machine. It then monitors the timecode adjusts the slaves' transports continually to maintain *frame lock*. See also *resolver, reference source*.

R

resolving: The process of *synchronizing* the internal clock(s) on one or more devices to an external *master clock*.

resonance: The sympathetic or induced vibration of a system (a solid, a membrane, or an air space) in response to the presence of vibration in the air; the tendency of a mechanical or electrical system to vibrate at a certain frequency when excited by an external force and to keep vibrating after the excitation is removed, e.g., a bell. When a vibrating object (such as a guitar body) is stimulated by a second *oscillator* (such as a vibrating string), its pattern of vibration may be altered. If the two vibrate at the same or a *harmonically* related frequency, they tend to *phase-lock* together, reinforcing the sympathetic vibration at this common *resonant frequency*. Oscillations at non-harmonic frequencies have far less effect due to *phase cancellation*. (1) A function of a filter in which a narrow band of frequencies, the *resonant peak*, becomes relatively more prominent. If the resonant peak is high enough, the filter will begin to oscillate, producing an audio output even in the absence of input. Filter resonance is also known as *emphasis* and *Q*. It is also referred to in some older instruments as *regeneration* or *feedback*, because feedback was used in the circuit to produce a resonant peak. (2) The tendency of a speaker to vibrate most at a particular frequency; sometimes referred to as the *natural frequency*.
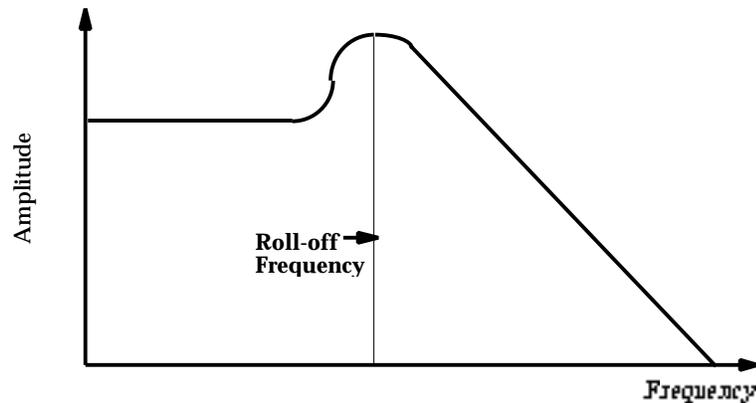
Low-Pass Filter with Resonance

resonant filter: Nearly all musical instruments are a type of resonant filter, i.e., they pass certain particular frequencies and attenuate others, producing the tuning of the instrument. Each instrument, from a simple electrical resonator to a complex resonant system such as a guitar or organ pipe take an initial *impulse* and impress upon it the particular *transient* profile which gives the resonator its unique *timbre* and *pitch*.

resonant frequency: See *resonance*, *loudspeakers*.

resonator: An acoustic device that has a *resonance*. Virtually all musical instruments have some sort of resonator as part of their tone-producing mechanisms.

response pattern: See *polar pattern*.

restored timecode: In *SMPTE timecode* synchronization, a newly generated, continuous timecode that will maintain sync with an external reference code. Used to replace a discontinuous timecode, such as one that includes unrelated segments of code, perhaps copied from unrelated scenes and *takes*. See *jam sync*.

R

resultant tone: See *difference tone.*

resynthesis: A form of synthesis/sampling which is based on the analysis of sound data which is later used to reconstruct the sound, usually hundreds of sine waves which collectively build up the harmonic content of the sound, sometimes with the imposition of additional parameters and/or constraints, but all in *real-time.* This means that only small amounts of data need to be stored, unlike traditional sampling, and that any parameter of the sound can be infinitely changed. This new technology should allow the faithful recreation of any existing instrument and the creation of truly original sounds and textures. Material construction, acoustic response, perspective, morphing between sounds and transformations, such as blowing a piano, in any dimension will be possible.

retentivity: The *flux density* present on a specific type of magnetic recording tape after a magnetic field of *saturation* strength is removed. The maximum flux density the tape can store. See also *remanence.*

return: See *send.*

reverb: A type of signal processing *effect* which produces a continuous wash of echoing sound, simulating an acoustic space such as a concert hall. See *darkness, reflection, echo, DSP.*

**reverb plate**: See *plate reverb.*

reverb spring: A spring which is used to produce *reverberations.* One *transducer* causes it to vibrate and the reflected wave motions are picked up by other transducers.

reverberant field: In a room with *reverberation,* if a listener is close to source of sound, the direct sound will predominate, and the listener is said to be in the *direct field* of the source. At greater distances, the reverberant energy will predominate, and this region is called the reverberant field. See also *free-field, near-field, far-field, decay*(**3**).

R

reverberation: The decaying residual signal that remains after a sound occurs, created by multiple reflections as the original sound wave bounces off walls, furniture, and other nonabsorbtive barriers within a room or other acoustical environment. Reverberation contains the same frequency components as the sound being processed, but no discrete *echoes*. An average club has a natural *reverberation time* of about a half-second; many concert halls and auditoriums have a natural reverberation time of two seconds or more. A room with very little reverberation is called a *dead* room, which is the opposite of a *live* acoustic space which is very reflective. Reverberation is composed of *early reflections* and later reflections.

High-frequency sound waves have to cause the surrounding air molecules to vibrate quickly enough to pass the sound energy onwards, consequently high-frequency reflections die out faster than mid-frequency or bass reflections. Also, high-frequency sound is more readily absorbed by soft furnishings. Low-frequency sounds are only reflected by large and heavy objects, so there may be very little low-frequency reverberant sound. However, in larger rooms, there can be substantial *bass build-up*.
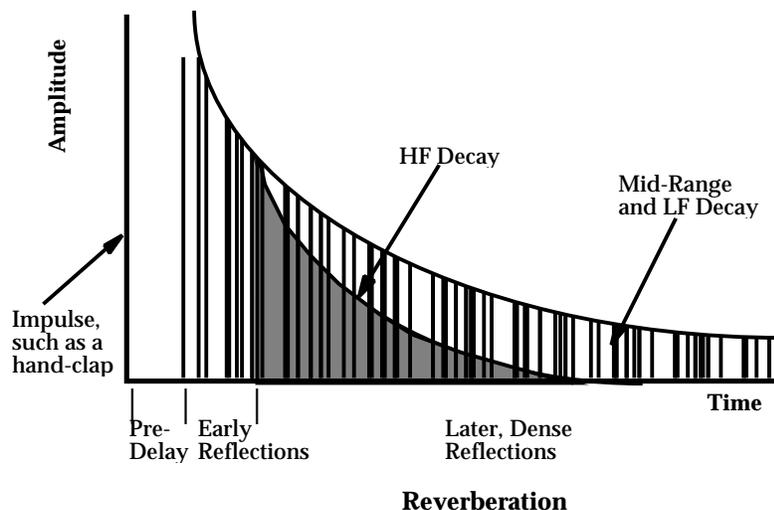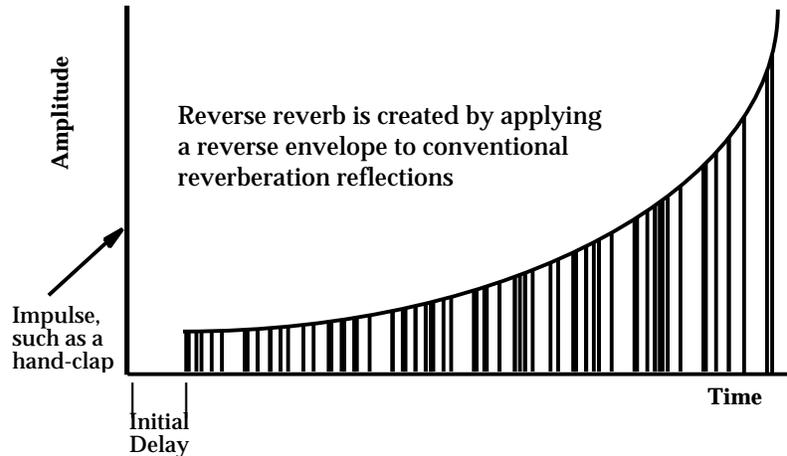

Reverberation

reverberation time: The time of reverberation is defined as the time it takes for the *SPL* to *decay* to one-millionth of its former value, a 60dB reduction, hence called the *RT-60* of the space. Also called *decay time*.

reverberator: A device for the generation of synthetic *reverberation*, either analog, such as a *plate* or *spring reverb*, or a digital *effects processor* which simulates the reverberation according to various *parameters* such as room size (small, medium, large) and room type (club, cathedral, studio).

R

reverse reverberation: A digitally simulated effect whereby a sound envelope is created by the usual *attack, release,* and *sustain* stages, but the *decay* portion of the envelope is purposely reversed so that the reverberant sound increases in amplitude, rather than naturally decreasing.

Reverse reverb is created by applying a reverse envelope to conventional reverberation reflections

Reverse Reverb from a Percussive Sound

rewind motor: See *supply motor.*

RFI: Radio Frequency Interference. Caused by radio stations, cellular phones, and other sources of radio energy that is transmitted through the air, RFI is a common source of induced noise. See *induction, EMI.*

RFZ: Reflection Free Zone. For example, hopefully the mix position in a studio. As with the *LEDE* school of control room design, both acoustic designs seek to create a room which imposes none of its own character upon the audio. As opposed to early sound scattering (*ESS*) control room designs.

rhythm: The *beat, tempo, measure* and *meter* of the music, plus the variation of beats as they are superimposed over the main pulse.

rhythm track: Basic tracks usually recorded first in a multitrack session. These are generally played back for the musicians as a *cue mix* for dubbing purposes.

RIAA: Recording Industries Association of America. An industry body set up to define standards and practice in the recording industry. In particular, its internationally accepted standard for the recording characteristic involving *emphasis* and de-emphasis for vinyl records. See also *SMDI, RIAJ.*

R

RIAA Curve: An *equalization curve* established by the RIAA and applied to all music as it is transferred from *master tape* to master disc. This *pre-emphasis* curve introduces a 20dB skew in the frequency content of the program, decreasing the bass content and increasing treble over a 500Hz threshold. The complementary *de-emphasis* is applied by the phonograph preamplifier during reproduction. Since groove width increases in proportion to the low-frequency content of the program, and since vinyl disc surface noise is most noticeable in the high frequencies, the RIAA curve is designed to enable more dense program recording while minimizing the effect of surface noise.

RIAJ: Record Industry Association of Japan. The Japanese equivalent of the *RIAA*.

ribbon microphone: A type of *dynamic microphone* which has a thin metal foil, or ribbon, suspended in a magnetic field. Sound waves vibrate the ribbon in the field and generate an electrical signal. Ribbon mics are usually quite fragile, but are used for their warm, smooth tone quality. They work well with digital recording and on brass instruments to mellow the tone. Ribbon mics are either *figure-eight* or *cardioid*. See also *condenser microphone*.

ribbon tweeter: A high-frequency *loudspeaker*. The audio signal is connected to the ribbon, which is a very thin (usually aluminum) strip suspended in a magnetic field. The *current* in the ribbon establishes another magnetic field, causing the ribbon to move in synchrony with the input signal waveform, hence, is a *direct radiator* of sound. Ribbon tweeters are effective at very high frequencies, and usually require a step-down transformer because of the very low *impedance* of the ribbon.

riff: A short, catchy musical phrase usually played between lyric lines in a song, often repetitively, thereby acting as a *hook*.

RIFF: Resource Interchange File Format. A file specification adopted jointly by Microsoft and IBM for multimedia sound applications.

rifle microphone: See *gun microphone*.

ringing: Any device, electronic or mechanical, is said to ring if it continues to produce a signal or to move after its input is stopped. Ringing, a type of *transient distortion*, is caused by too little *damping*, and is particularly prevalent in audio *transducers*. Low-frequency ringing is called *hangover*.

ring modulator: A special type of *timbre* modifier module that accepts two signals as audio inputs and produces their sum and difference tones at its output, but does not pass on the frequencies found in the original signals themselves. This greatly increases the number of *harmonics* contained in the two sounds and introduces a gross nonlinearity, causing huge amounts of *harmonic* and *intermodulation distortion*. The ring modulator is used in the generation of electronic music, usually in conjunction with a *lowpass filter* which reduces the high-frequency roughness of the resulting metallic sound. It gets its name from its circuit configuration which is a circle, or ring, of four *diodes*. See also *oscillator sync*.

ripping: The process of extracting samples from *MOD* files for use in digital compositions.

ripple: (1) Irregularities in the *frequency response* of a filter which has a nominally flat response in its *passband*, or (2) irregularity in the value of *DC* voltage in a power supply which manifests itself as *hum* in the loudspeakers.

R

RMS: Root Mean Square. A formula for describing the *level* of a signal. RMS is derived by squaring all of the instantaneous voltages along a waveform, averaging the squared values, and taking the square root of that number. For sine-like signals,

<div align="center">

average power = RMS(voltage) × RMS(current)

</div>

The voltage of an audio signal is usually measured in terms of the RMS value of the signal. The *RMS value* of an alternating current produces the same heating effect in a circuit as the same value of a direct current.

Robinson-**Dadson curves**: See *equal loudness curves.*

rock and roll: A system used in *dubbing* or mixing by which the projector, dubbers, and recorder can run in synchronization in reverse. Thus, if a mistake is made in mixing a particular section, all sources can be rolled back past the mistake, and a new take can be *punched-in* before the mistake. Also called *rollback. Selsyn motors* on all machines involved are required to make rock and roll possible.

rollback: (1) See *rock and roll.* (2) On video recording/editing systems, the rollback, or *RLB*, function is used to rewind machines by a predetermined amount from the current position. The default rollback time is 15 seconds.

rolloff: (1) The difference between the input amplitude and the output amplitude in a filter over a specified frequency band, expressed in dB. (2) See *rolloff filter, rolloff slope.*

rolloff filter: A filter which has a reduced output as the frequency is increased is called a rolloff filter. A tone control is a rolloff filter when turned down. Sometimes the attenuated portion of the frequency content of the signal itself is called *rolloff.* A circuit that attenuates a signal that is above (*lowpass*) or below (*highpass*) at specified frequencies. For example, microphones usually have a bass rolloff filter to remove wind noise and/or excessive breath pops.

rolloff frequency: The frequency above or below which a filter begins to filter out the *harmonics* of the *waveform.* As the rolloff frequency is raised or lowered, more of the harmonics of the sound will be filtered out. Specifically, the frequency at which the response of an equalizer or other audio device is reduced by 3dB, and can refer to both lowpass and highpass response curves. The rolloff frequencies of an amplifier are the frequencies where the output voltage drops to 0.707 of the middle range output. A decrease of the voltage by a factor of 0.707 is equivalent to -3dB, so these critical frequencies are often referred to as the *3dB down points.* Also called *cutoff frequency, critical frequency,* **or the** *half-power point.* **Moving the rolloff frequency in real-time will produce a** *wow* **effect, which can be accentuated by increasing the** *filter resonance* **level.**

rolloff slope: The acuity of a filter's *rolloff frequency.* Rolloff is generally measured in dB/octave. A shallow slope, such as 6dB per octave, allows some frequency components beyond the rolloff frequency to be heard, but at a reduced volume. When the rolloff slope is steep (on the order of 24dB/octave), frequency components very close to the rolloff frequency are reduced in volume so much that they fall below the threshold of audibility. Rolloff slopes are sometimes called *skirts.* See *filter, pole, sharp*(2).

R

room equalization: The alteration of the *frequency response* of signals that will be sent to speakers or monitors, done in order to compensate for *room modes.* These problems are generally identified by sending *pink noise* to the speakers, then adjusting the frequency response of the resulting sound that arrives at the listening position. Most room EQ references use ⅓-octave 31-band graphic equalizer, with additional over-all bass and treble adjustments. See also *RTA.* Also called *voicing.*

room mode: Also called *standing waves*, room modes come in three types: axial, along the axes of a room (front to back, side to side, floor to ceiling); tangential, or any two pairs of opposite surfaces; and, oblique modes which are the product of the reflections of all six surfaces. To calculate the frequency of a particular mode,

$$f = \frac{c}{2} \sqrt{\left(\frac{n_x}{L_x}\right)^2 + \left(\frac{n_y}{L_y}\right)^2 + \left(\frac{n_z}{L_z}\right)^2}$$

Where *f* is in *Hertz, c* is the speed of sound (1130 ft./sec. or 344 meters/sec.), *L* is the room dimension, and *n* is the order of the mode. It's not important to know the frequencies of the room mode, just how evenly spaced they are. If they are not uniformly distributed, the room will show a response peak where they are nearly coincident. The most problematic frequency range is 50Hz-150Hz. The golden ratios of height to width to length are: 1.14:1.39:1 or 1.28:1.54:1 or 1.60:2.33:1 (Bolt's golden ratios), then the modes will be perfectly spaced and low-frequency response is smooth by design. See also *standing wave.*

room sound: The characteristic *ambient* sound of a concert hall or other listening space.

room tone: The *ambient noise* of a room, set or location where dialog is recorded for the production shoot. Usually recorded as wild sound, room tone is used by film and dialog editors as a *bed* to form a continuous tone through a particular scene. Not to be confused with *ambience,* which can be sound effects and/or reverberation added when the dialog is mixed. See also *NC Curve, walla.*

root: The lowest note of an uninverted *chord,* and therefore the note which usually gives the chord its name. For example, in a triad, it is the lowest note when the chord is arranged as two thirds on top of one another: C is the root of the chord of C (C, E, and G), an arrangement known as *root position.* If the root is not the lowest note, the triad is said to be *inverted.*

root mean square: See *RMS.*

rotary head: The video recording system that uses a rotating drum carrying two or more heads which sweep across the tape at a small angle, typically 5˚-8˚. This allows a high rate of scanning to be combined with a low tape speed.

R

rotation point: In a *compressor* or *expander*, the input signal level at which the graph of the device's *transfer characteristic* intersects its *unity gain* curve. At this level, there is no net change from input to output level.

Rotation Point
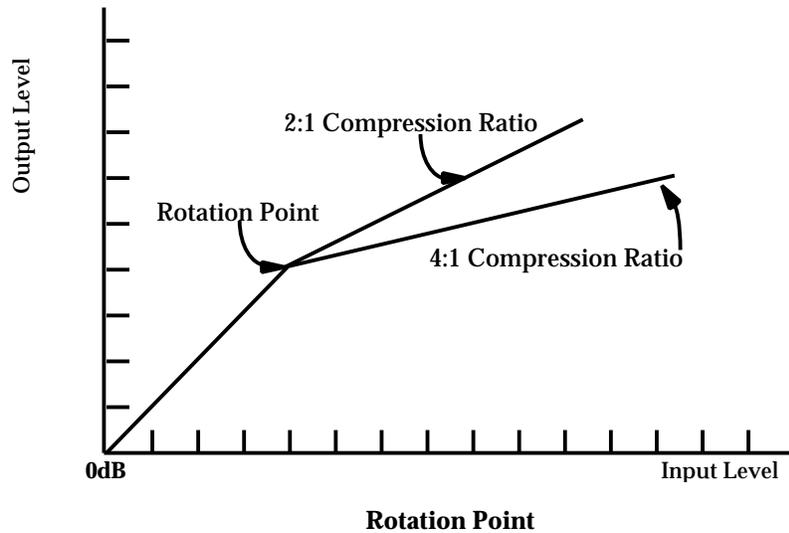
rough cut: A stage in the editing of the *workprint* or videotape at which the scenes and shots are in order and cut approximately to their correct length, between an assembly and a *fine cut*. See *copy editing*.

rough mix: A mix of a recording in progress, either as it occurs or, in the particular case of a stereo mixdown of a multitrack recording, one made at the end of a day's work for overnight audition.

routing: (1) (*verb*) The process of directing a signal from one point to another. (2) (*noun*) The pathway a signal takes, e.g., through which busses it passes on a mixing desk.

Rt: See *stereo optical print*.

RT-60: The *reverberation time* of a space. Suggested times for various room volumes are:

Room Vol. (10^3 cu.ft.)	Range of RT-60 Times (seconds)
1-2	0.3-0.4
2-3	0.3-0.55
3-5	0.4-0.65
5-7	0.45-0.7
7-10	0.5-0.75
10-15	0.55-0.8
15-20	0.65-0.9

R

RT-60 meter: A hardware device for measuring the acoustical characteristics of a listening/recording space. Gated *pink noise* is played and analyzed by the meter. The meter then provides a read-out of the locations reverb profiles for the different frequencies, usually 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, and 4kHz.

RTA: Real-Time Analyzer. A piece of hardware that measures the *loudness* of an audio signal, either through a flat-response microphone or a line input, and categorizes the loudness into different frequency bands, used to flatten out the *frequency response* of a monitoring system. An RTA usually displays frequencies at one *third-octave* or octave *bands*. The decibel level of each frequency band is displayed graphically.

RTSP: Reat-Time Streaming Protocol. An internet protocol for real-time transmission of high-fidelity audio, suitable for live concert feeds as well as professional audio applications. See *RealAudio.*

rubato: A musical term indicating that a conductor or musician may take expressive liberties with the *tempo* during the designated section of a score.

rumble: A low-frequency mechanical vibration in a turntable, microphone, or tape transport. Rumble is specified as a *S/N ratio* in decibels, with -50dB being common.

rumble track: Stereo *white noise* lowpass filtered at about 40Hz so as to be felt and not heard.

run: A command used by DOS to launch an application program. The RUN command may be used with various switches (subcommands) and is uniquely powerful and straightforward. This is no doubt owing to the sacred–cow status of the command conferred by its origin in the numerous progenitors of DOS, decades before anyone from Microsoft could confuse it.

running master: The same as a *print master.*

running status: A *data compression* scheme for MIDI data whereby status bytes can be skipped if they would be the same as the most recent status byte. For example, a four-note chord can be transmitted using only nine bytes rather than the usual twelve. See also *MIDI delay*(2).

rushes: See *dailies.*

rustle: See *Foley.*