
THE AUDIOPHILE'S GUIDE TO PHONORECORD PLAYBACK EQUALIZER SETTINGS

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It is especially appropriate that this guide has been released on the occasion of the 40th anniversary of the Columbia LP Microgroove disc. Interest in old records has been increasing now that tape cassettes and compact discs have taken over the market once dominated by LPs and 45s. Frequently, it is forgotten that our modern Record Industry Association of America (RIAA) curve for recording and playing back discs has been a standard only since 1953. Most record manufacturers had switched to RIAA by 1955, save for some "die hards." It took the introduction of the stereo record, as well as re-affirmation of the RIAA standard in 1964, to finalize the changeover.

It is a mistake, therefore, to play 78s or LPs using the RIAA playback equalization curve unless it is a certainty that this curve actually was employed in the recording process. Depending on the type, brand, and age of the recording, the usual result of such a mistake is muddy, or perhaps a tonally unbalanced, harsh sound. Improved results may be obtained by making knowledgeable use of playback equalization guidelines. For example, the proper curve to use when playing back acoustic recordings bears no resemblance to the RIAA curve. Likewise, depending on the age of the electrical recording and whether it was made in Europe or the United States, a menu of curves exists from which to select appropriate ones to try. The key to choosing which curve to use lies in knowing the record type (78, LP, 45), the brand of record, and the date or period when it was produced.

Interest in playing old records waxes and wanes, but almost without exception renewed interest appears when the "hi-fi," or even the "lo-fi," hobby is supported by readily available technology. Three important technological advances have generated this renewal of interest.

DIAL PHONORECORD EQUALIZATION WITH FILTERS

Playback of discs using equalization curves other than RIAA can be a challenge using modern equipment. The best way is to use preamplifiers or equalizers with exact settings for the old curves. However, most equipment of this type became obsolete by the time the stereo disc was introduced in 1958. But a few quality devices for the audiophile

have appeared since then. One is the Owl 1 Restoration Module (Owl Audio Products, Inc., P. O. Box 3122, Linden, NJ 07036.) This unit provides dial phonorecord equalization, as well as very effective noise reduction capabilities achieved with a low frequency rumble filter and a high frequency notch filter, both variable. Among other features for the playback of cylinders, 78s, and LPs, the Owl 1 provides extensive turnover and rolloff equalization settings (i.e., turnover: flat, 250, 375, 500, 750, 1K, RIAA; rolloff: flat, 5, 8.5, 12, 14, 16, RIAA).

TRUNCATED ELLIPTICAL STYLI FOR 78s

Technology that enabled state-of-the-art playback of stereo microgroove discs has been applied to the problems associated with reproducing 78s. New truncated elliptical styli now make it possible to get every useful vibration out of old shellac grooves. Most people associate "scratchiness" with 78s. But a truncated elliptical stylus has two properties designed to pick up less noise from the grooves and reproduce a more accurate signal. Because it is truncated, the stylus rides above the bottom of the groove. Groove cutting practices for 78s varied. If the truncated stylus encounters a V or a U shaped groove, the flattened stylus tip will not touch the bottom of the groove and generate noise. "Elliptical" refers to the fact that the stylus tip is about one-third as wide front-to-back compared to a spherical stylus (e.g., 2.8 x 0.9 mil). The narrow edges of the elliptical stylus help to resolve high frequencies, particularly as the stylus traverses the inner grooves close to the record label. Truncated elliptical styli of various sizes that fit the Stanton 500 pickup cartridge also are available from Owl Audio Products, Inc.

THREE SPEED QUARTZ CONTROLLED SEMIAUTOMATIC TURNTABLE AND ARM

A modern turntable with 78 rpm speed capability is becoming hard to find, but the Dual CS 5000 (Dual GmbH., St. Georgen, Germany) single-play three speed turntable with belt drive currently is available in the United States. This remarkable turntable has quartz controlled speed regulation with excellent accuracy, low wow and rumble. In addition, it has its own high quality semiautomatic pickup arm that is very easy to adjust (i.e., weight balance, stylus overhang, tracking pressure, antiskate, and arm drop height). The cartridge shell also enables vertical tracking angle adjustment. Each of the four turntable feet may be adjusted to obtain proper leveling as well as achieve damping for minimum acoustic feedback.

Of course, much more is involved in effective playback of phonorecords. However, these subjects will be detailed in a forthcoming technical manual entitled "The Audiophile's Guide To Taping 78 rpm and Old Microgroove Recordings." The playback equalization settings listed here are based on new research into the technical literature. Wherever possible, data presented is the consensus of several authorities.

Overall, the audiophile should remember that the equalization settings in Table 1 below are for 78s, as well as for many LPs and 45s which were available in the 1953-57 period. In Table 1, record brand or type is listed under the column "manufacturer." In the "speed" column, the appropriate turntable rpm is indicated. Under the headings "turnover" or "rolloff" are found the recommended equalizer settings. If the value is given in parentheses, it is the optimum setting to use for a dial equalizer like the Owl.

Equalizer Settings

1. Table 2 explains "dates, guidelines and definitions" used in Table 1. The last column at the right contains numbers referring readers to Table 3, "References and notes."

Table 4 is designed for those who do not have a dial equalizer. The purpose of the table is to show how bass and treble controls can be used to modify the standard RIAA curve to approximate some of the old equalization curves. It is assumed that playback equipment can provide bass boost at 50 Hz as well as treble boost at 10 KHz. For more information, consult the appropriate equipment manuals.

TABLE 1
RECOMMENDED PLAYBACK EQUALIZER SETTINGS
FOR RECORDS NOT USING THE RIAA CHARACTERISTIC

Manufacturer	Speed	Turnover	10 KHz	Rolloff
Acoustic records	78 rpm	0	0 dB	(1a)
AES equal. records	All	400 (375)	-12	(2a)
Allied	33 1/3	NAB (500)	NAB-16	(3,3b)
Amer. Rec. Soc.	33 1/3	AES (375)	AES-12	(3)
Arizona (55)	33 1/3	AES (375)	-12.7 (-12)	(3)
Atlantic	33 1/3	NAB (500)	NAB-16	(3,4)
Audio Fidelity	33 1/3	NAB (500)	NAB-16	(3,5)
Audiophile	33 1/3	NAB (500)	AES-12	(3)
Bach Guild	33 1/3	NAB (500)	NAB-16	(3,3b,6)
Bartok	33 1/3	630 (750)	-16 (NAB)	(2,3,3b,7)
Blue Note (55)	33 1/3	AES (375)	AES-12	(1,2,3)
Boston	33 1/3	LP (500)	NAB-16	(3,3b)
Brunswick	78	E78 (500)	0	(2)
Caedmon	33 1/3	630 (750)	-11(-12)(LON)	(2,3)
Caedmon	33 1/3	630 (750)	NAB-16	(3,3b,8)
Canyon	33 1/3	AES (375)	AES-12	(2,3,9)
Capitol (55)	33 1/3	AES (375)	AES-12	(1,2,3)
Capitol	45	AES (375)	AES-12	(1)
Capitol (1942)	78	AES (375)	AES-12	(1,2)
Capital-Cetra (55)	33 1/3	AES (375)	AES-12	(2,3)
Cetra-Soria (55)	33 1/3	AES (375)	AES-12	(2,3,3b)
Cetra-Soria	33 1/3	LP (500)	NAB-16	(3)
Colosseum (1/54)	33 1/3	NAB (500)	NAB-16	(3)
Columbia (55)	33 1/3	LP (500)	NAB-16	(1,2,3,3b,3c)
Columbia	45	AES (375)	AES-12	(1,2)
Columbia (1925*)	78	200 (250)	-7 (-8.5)	(3a)
Columbia (1938)	78	300 (250)	NAB-16	(1)
Columbia (Engl.)	78	250	0	(1a,2a)
Concert Hall	33 1/3	LP (500)	-16	(1)
Concert Hall (54)	33 1/3	RIAA	LON (-8.5)	(3)
Contemporary	33 1/3	AES (375)	AES-12	(3,10)
Cook Labs.	33 1/3	NAB (500)	NAB-16	(3,4)

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Manufacturer	Speed	Turnover	10 KHz	Rolloff
Coral	33 1/3	AES (375)	-12	(1)
Coral	33 1/3	NAB (500)	NAB-16	(3,3b)
Coral	78	AES (375)	-12	(1)
Decca	33 1/3	AES (375)	AES-12	(1,2)
Decca (11/55)	33 1/3	NAB (500)	NAB-16	(3,3b)
Decca	45	AES (375)	AES-12	(1)
Decca (1934)	78	AES (375)	AES-12	(1,2)
Decca FFRR (1951)	33 1/3	300 (250)	-14	(2a) Decca
FFRR (1953)	33 1/3	450 (500)	-10 (-8.5)	(1a)
Decca FFRR (1949)	78	250	-5	(1a,2a)
Dial	33 1/3	LP (500)	-16	(1)
Early 78 (mid 30s)	78	E78 (500)	0	(2)
Elektra	33 1/3	AES (375)	AES-12	(3,12)
Elektra	33 1/3	630 (750)	NAB-16	(3,13)
EMI	33 1/3	500	-16	(1a)
EMI (1931)	78	250	0	(1a,2a)
EMS	33 1/3	AES (375)	AES-12	(2,3)
Epic (54)	33 1/3	LP (500)	NAB-16	(3)
Esoteric	33 1/3	AES (375)	AES-12	(3,14)
Folkways (55)	33 1/3	LP (500)	NAB-16	(3,3b)
Good Time Jazz	33 1/3	AES (375)	AES-12	(3,15)
Good Time Jazz	33 1/3	NAB (500)	NAB-16	(3,16)
Haydn Society	33 1/3	LP (500)	NAB-16	(1,2,3,3b)
HMV	33 1/3	LP (500)	NAB-16	(1a,3,3b)
HMV (1931)	78	250	0	(1a,2a)
Kapp	33 1/3	800 (750)	NAB-16	(3,3b)
Kendall	33 1/3	NAB (500)	NAB-16	(3,3b,17)
London FFRR	33 1/3	450 (500)	-10 (-8.5)	(2,3,3b,18)
London FFRR (1949)	78	250	-5	(1a,2a)
Lyricord	33 1/3	AES (375)	-16	(2)
Lyricord	33 1/3	630 (750)	-16 (NAB)	(3)
Lyricord	33 1/3	LP (500)	NAB-16	(3)
Mercury (10/54)	33 1/3	AES (375)	AES-12	(1,2,3,3b)
Mercury	45	AES (375)	AES-12	(1)
Mercury	78	AES (375)	AES-12	(1)
MGM	33 1/3	NAB (500)	AES-12	(1,2,3)
MGM	45	RIAA	-12	(1)
MGM	78	RIAA	-12	(1)
NAB equal. lat.	All	500	-16	(1b)
NAB equal. vert.	All	400 (375)	-18 (-16)	(1b)
Nocturne	33 1/3	AES (375)	AES-12	(3,19)
Oceanic	33 1/3	LP (500)	NAB-16	(1,2,3,3b)
L'Oiseau-Lyre (54)	33 1/3	LP (500)	LON (-8.5)	(3,3b)
Overtone	33 1/3	NAB (500)	NAB-16	(3,20)
Oxford	33 1/3	LP (500)	NAB-16	(3,3b)

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Manufacturer	Speed	Turnover	10 KHz	Rolloff
Pacific Jazz	33 1/3	AES (375)	AES-12	(3,21)
Parlophone	78	E78 (500)	0	(2)
Philharmonia	33 1/3	AES (375)	AES-12	(1,2,3)
Polymusic	33 1/3	NAB (500)	NAB-16	(2,3,3b,4)
Remington	33 1/3	NAB (500)	-16	(2,3,3b)
Riverside (55)	33 1/3	AES (375)	AES-12	(3,3b)
Tempo	33 1/3	NAB (500)	NAB-16	(3,3b)
Transradio	33 1/3	LP (500)	NAB-16	(3)
Urania (Most)	33 1/3	NAB (500)	NAB-16	(2,3)
Urania (Some)	33 1/3	AES (375)	AES-12	(3,22)
Vanguard	33 1/3	LP (500)	NAB-16	(1,2,3,3b,23)
Vox	33 1/3	NAB (500)	NAB-16	(3)
Vox (54)	33 1/3	LP (500)	NAB-16	(1,2,3)
Victor (8/52)	33 1/3	500	-12	(3,3a,3b)
Victor (8/52)	45	500	-12	(3a)
Victor (1925*)	78	200 - 500	-7 (-8.5)	(3a)
Victor (1938-47)	78	500	-7 (-8.5)	(3a)
Victor (1947-8/52)	78	500	-12	(3a)
Westminster	33 1/3	NAB (500)	NAB-16	(3)
Westminster	33 1/3	AES (375)	AES-12	(3,3b)
Westminster (10/55)	33 1/3	LP (500)	NAB-16	(2,3,3b)

TABLE 2
DATES, GUIDELINES, AND DEFINITIONS

Dates

If the date is written as the complete year (e.g., 1925 or 1938-47) this means the beginning or period of a given equalization practice. Date beside record manufacturer (e.g., 54 or 8/52) indicates when a change was made to RIAA. For more detail see specific record numbers. Also examine the record jacket. Sometimes the manufacturer indicated what recording characteristic was used. Typically, nothing was stated, hence the audiophile must consult other information sources.

Guidelines

LP Guidelines: Except where indicated, try a 500 Hz turnover and a -16 dB rolloff at 10 KHz for discs issued before 1955. This recommendation is based on the fact that the Columbia LP playback characteristic and its progenitor, NAB (NAB vs. LP: Hz +5 dB, 63 to 125 Hz +3 dB, same as LP above 200 Hz) were used widely for microgroove recordings. After 1955, most record producers used the RIAA curve.

45 rpm Guidelines: Most employed the AES turnover and rolloff. However, there were exceptions, such as RCA Victor which introduced the 45 rpm record in February, 1949. Use RIAA for pressings after 1955, or earlier where noted.

78 rpm Guidelines: Except where noted, many electric 78s used the following; turnover = 500 Hz; rolloff = 0. This is commonly referred to as a “flat cut.”

Another approach may be used for electric 78s with an unknown recording curve. Set turnover and rolloff to 0 or flat. Sequentially try turnover at 250, 500, etc. and listen for bass balance. If bass sounds thin, increase turnover. If it sounds woofy, decrease turnover. Check midrange and treble balance. If treble, not noise, predominates set rolloff to -5, -8.5, etc. Avoid a dull, lifeless sound. Check overall bass, midrange, and treble balance. If satisfactory, turn filters on. Use just enough rumble filter as well as high frequency filter to take away low and high pitched noise respectively without upsetting bass, midrange, and treble balance. European 78 rpm recordings as a rule require a low turnover setting (ca. 250) and 0 rolloff.

Definitions

Acoustic recordings: This kind of recording was not produced by electric means. Instead, people played instruments or sang in front of a large conical, megaphone style horn. The horn was connected by a hose to a mechanical diaphragm. Sound vibrations moved the diaphragm which in turn caused a wax cutting stylus to cut a vibrating groove onto a rapidly rotating thick disc of wax. Pressings were made by a subsequent process. The frequency versus intensity characteristic of acoustic recordings is referred to as constant velocity. This means that as frequency decreases, intensity increases and as frequency doubles, intensity halves. Most of the energy of these recordings was concentrated within 150--4,500 Hz and response fell rapidly outside of this range. Consequently, acoustic recordings lacked much bass and treble chiefly because high sound energy was required to overcome limitations of the mechanical groove cutting system. In spite of this, towards 1925 when electrical recording was introduced commercially, there were many fine examples of acoustically produced recordings, but typically they had a ventriloquistic overall sound, plagued with spurious resonances.

AES: Audio Engineering Society playback standard, 1951. Turnover = 400 HZ (0 dB reference = 1 KHz.), 10 KHz rolloff = -12dB.

Columbia (1938): Columbia Records (U.S.) was bought by Columbia Broadcasting System (CBS) in 1938.

Columbia (Engl): English Columbia bought American Columbia in 1925 to acquire electric recording rights. The company also bought Pathé Freres in 1928. See EMI.

dB: Decibel or 1/10th of a Bel, a logarithmic unit of signal or intensity measurement.

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Decca (1934): U.S. Decca established in 1934 by Jack Kapp and associates.

EMI: Electric & Musical Industries, Ltd. formed on March 31, 1931 by merger with His Master's Voice and Columbia. Includes English Columbia, HMV and Pathé records. Turnover = 250 Hz, 10 KHz rolloff = 0 at 15 KHz-5dB.

E78, and Early 78: Heath WA-P2 pre-amplifier setting for old 78s. Turnover = 500 Hz (50 Hz = +17.5 dB), 10 KHz rolloff = Flat or 0.

FFRR: Full Frequency Range Recording (English Decca). Originated the process in 1941 to enable the Royal Navy to distinguish between British and German submarines. It was used commercially beginning in 1944. Decca Record Co. formed in 1929. London is the United States equivalent of English Decca.

<u>Date</u>	<u>Turnover</u>	<u>Rolloff</u>	<u>Type</u>
1953	450 Hz	-10.5 dB	Micro.
1951	300	-14	Micro.
1949	250	- 5	78 rpm

HMV: His Master's Voice. See EMI.

Hz: Hertz or cycles per second. Frequency or rate of signal vibration. Analogous to sound pitch: low to high, or bass-midrange-treble. 50 Hz is a low frequency; 10,000 Hz is a high frequency and noted as 10 KHz.

LP: Long Play (Columbia 33 1/3 rpm microgroove) introduced on June 21, 1948. Turnover = 500 Hz (modified NAB), 10 KHz rolloff = -16 dB. LP vs. NAB: 32 Hz -5dB, 63 to 125 Hz -3 dB same as NAB above 200 Hz. Bass lift vs. NAB was designed to reduce rumble and hum pickup.

NAB: National Association of Broadcasters recording and playback standard, 1949. Turnover = 500 Hz (0 dB reference = 700 Hz), 10 KHz rolloff = -16 dB.

RIAA: Record Industry Association of America recording and playback standard, 1953. Turnover = 500 Hz (0 dB reference = 1 KHz), 10 KHz rolloff = -13.7 dB.

Rolloff: This is the rate of treble attenuation in dB at 10 KHz during record playback. Rolloff is used to match a corresponding rate of treble pre-emphasis employed in the recording process to improve high frequency response and reduce surface noise such as hisses, clicks, and pops. If an incorrect rolloff is used in playback, high-midrange and treble balance will sound too bright or too dull.

Turnover: Bass turnover frequency is that frequency which is +3 dB from the 0 dB reference portion of the playback curve. Below the turnover frequency, bass must be boosted to compensate for a corresponding rate of attenuation that was used in the recording process to minimize overcutting which would cause mistracking or groove

hopping in playback. If an incorrect turnover is used in playback, low-midrange and bass balance will sound too woofy or too weak.

Victor (1925*): Turnover for these early Victor electric recordings varied but tended to average 500 Hz. Check bass balance carefully for recordings from 1925 to the mid 1930s. When Victor improved the original Western Electric "rubber line" wax recorder, the pressings were called "Orthophonic." Early Columbia (U.S.) electric recordings, Columbia (1925*), are believed to be very similar to the Western Electric recorder characteristic.

Victor (1947-8/52): In August 1952, RCA Victor introduced "New Orthophonic" high fidelity recordings. With a few exceptions in the early 6000, 7000, and 9000 series, this applied to all LM, WDM, and DM records or albums above 1701, and LCT and WCT above 1112. It also included all LHMV, WHMV, LBC, WBC, and Extended Play 45s. The "New Orthophonic" characteristic was adopted by the industry as the RIAA recording and playback curve in 1953. For playback of prior Victor recordings, the same turnover and high frequency characteristic was recommended, but with a 4 to 5 dB increase at 50 Hz using the bass tone control.

-11 (LON): London 10 KHz rolloff of -10.5 dB is approximate.

-16 (NAB): NAB 10 KHz rolloff of -16 dB is approximate.

500: Turnover used by RCA Victor Records.

630: Turnover used by Bartok Records.

800: Turnover used by Kapp Records.

TABLE 3 REFERENCES AND NOTES

- (1) Tremaine, Howard M. *The Audio Cyclopedia*. Howard W. Sams: Indianapolis, 1959.
- (1a) Briggs, G. A. *Sound Reproduction*. 3rd ed. Idle, Bradford, Yorkshire, England, Wharfedale Wireless Works, 1953.
- (1b) Read, Oliver. *The Recording and Reproduction of Sound*. Howard W. Sams: Indianapolis, 1949.
- (2) Heath Company. *Assembly and Operation of the Heathkit Preamplifier Model WA-P2*. Benton Harbor, MI.: Heath Co., 1954(?).
- (2a) Langford-Smith, F., ed. *Radiotron Designer's Handbook*. 4th ed. Sydney, Australia: Wireless Press; Amalgamated Wireless Valve Co. Pty. Ltd., 1952. Also Harrison, NJ: RCA, RCA Victor Division, 1952.
- (3) *High Fidelity Magazine*, 1953-57.
- (3a) Moyer, R. C. "Evolution of a recording curve." *Audio Engineering*. (July, 1953): 19-22, 53-54.
- (3b) Owen, Tom. *Personal Communication*. Linden, NJ: Owl Audio Products, Inc., 1987.
- (3c) Goldmark, Peter C., Rene Snepvangers, and William S. Bachman. "The Columbia

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Long-Playing microgroove recording system." *Proceedings of the I. R. E.--Waves and Electrons Section*. 37:923-927. (August, 1949).

- (4) Binaural issues use NAB on the outside band, but on the inside band NAB was used for bass only, treble was flat. Play the inside band without treble rolloff.
- (5) Audio Fidelity; NAB: no. 901-903.
- (6) Bach Guild; NAB: no. 501-529.
- (7) Bartok; 630 (AES): no. 301-304, 309, 906-920.
- (8) Caedmon; 630: no. 1001-1022.
- (9) Canyon; AES: To no. C6160.
- (10) Contemporary; AES: no. 2001, 2002, 2501, 2502, 2505, 2507, 3501.
- (11) Contemporary; NAB: no. 2504.
- (12) Elektra; AES: no. 17, 22.
- (13) Elektra; 630: no. 2-5, 18-20, 24-26.
- (14) Esoteric; AES: no. ES 500, 517; EST 5, 6.
- (15) Good Time Jazz; AES: no. 3, 9-19.
- (16) Good Time Jazz; NAB: no. 1, 5-8.
- (17) Kapp; 800: no. 100-103, 1000-1001.
- (18) London; To no. 846.
- (19) Nocturne; AES: no. LP 1-3,5; XP 1-10.
- (20) Overtone; NAB: no. 1-3.
- (21) Pacific Jazz; AES: no. 1-13.
- (22) Urania; AES: no. 224, 603, 7059, 7063, 7065, 7066, 7069.
- (23) Vanguard; LP: no. 411-442, 6000, 6018, 7001, 7011, 8001-8004.

TABLE 4
USING BASS AND TREBLE TO MODIFY RIAA TO
REPLICATE OLD PLAYBACK EQUALIZATION CURVES

To get from RIAA to:	Bass (50 Hz)	Treble (10 KHz)
Acoustic (pre-1925, constant velocity)	-17 dB	+14 dB
Acoustic (practical) Use: rumble filter scratch filter	-6	-6
AES (1951)	0	+2
Columbia 78 (1938)	-2	-2
Columbia LP (1948)	-4	-2
Decca FFRR 78 (1949)	-8	+9

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To get from RIAA to:	Bass (50 Hz)	Treble (10 KHz)
Decca FFRR LP (1951)	-3	0
Decca FFRR LP (1953)	-3	+4
Early electric (1925) Turnover: 200 - 300 Hz Use scratch filter	-6	-6
EMI, HMV, English Columbia 78 (1931)	-6	-6
NAB (1949)	0	-2
Victor 78 (1925)	0	+7
Victor 78 (1938)	+5	+6
Victor 78 (1947) and subsequent 45 and 33 1/3	+5	+2
Victor 78, 45, 33 1/3 (1952)	0	0

