

PACKBURN[®] *electronics inc.*

MODEL 329AD PRE-AMP + AUDIO NOISE SUPPRESSOR

Silver Bullet Edition

OWNER'S MANUAL

Pre-amplifier

(3 Phono & 2 Hi Level Inputs)

+



**Transient Noise Suppressor
(pop, click & scratch filtering)**

and

**Continuous Noise Suppressor
(hiss & white noise filtering)**

TABLE OF CONTENTS

Flyer	i - iv
Foreword	Pg: 1
System Installation	3
Rear Panel Features	4
Front Panel Features	5
General Description of the Controls	6
Stereo Playback Instruction (33's – 45's)	8
Monaural Playback Instruction (mono 33's, 45's,78's)	9
Vertical-Cut Source Playback Instruction (Cylinders, Diamond Discs...)	10
Playback of Other Recorded Media (CD's- Cassette Tape- Broadcast)	11
Technical Descriptions	12
Optimal Playback of Phonograph Records	15
Recommendations for Preserving Perishable Media	16
Trouble-Shooting Procedures	17
Equalization- A general discussion (Stereo, Monaural, Vertical-cut)	18
Equalization Curves- by Name (mono 33's and 45's before 1955, 78s)	20
by Record Label (monaural 33's and 45's before 1955)	21
by Record Label (for 78's and historical sound records before 1953)	22



MODEL 329AD PRE-AMP + AUDIO NOISE SUPPRESSOR

A special pre-amp designed to eliminate or reduce noises due to imperfections in and damage to sound recordings in all analog audio media and their digital reproduction, including stereo vinyl and vintage vinyl, cylinder, disk, film wire and tape recordings

Model 329 contains "in one box" a phonograph pre-amplifier and processors designed to suppress transient noises (ticks, pops, clicks, crackle, scratch) encountered in some 125 years of phonograph recordings, wherever and however made, as well as the audible hiss familiar in all audio media prior to the development of successful encode/decode noise suppression systems and digital audio.

Model 329 also incorporates a number of necessities and conveniences for the optimum playback of disk and cylinder recordings for best quality of sound including bass and treble controls for stereo recordings, and turnover and rolloff equalization controls for earlier, monophonic recordings.

The Pre-Amplifier

The Packburn Model 329 has five switch-selectable inputs. Three inputs are designed to receive signals directly from up to three separate turntables – one or to two of them having MM (moving magnet) cartridges, the other having a (moving coil) cartridge. The fourth input is designed to receive signal from a turntable that has a built-in preamp or to the user's own phono preamp, whether it has flat equalization or RIAA equalization. The fifth input is designed for a second external preamp having flat equalization. CD players, tape players, or other high level signal source can be plugged directly into the fourth or fifth inputs or through the user's pre-amp to the Packburn.

Adjustments on the front panel include the five input selector switch, a mode switch for selecting whether the source material is stereo, monaural or vertical. ("Vertical" refers to an alternate monaural recording process used in

cylinders or some early disks.) There are two volume controls - the first for setting the level on the VU meter and the second for setting the level from the Packburn as desired by the user. A balance control matches the signal levels of the two channels.

The Transient Noise Suppressor- Stereophonic and Monophonic Records:

The TNS reduces transient noises in all recorded media - from newly issued vinyl disks - to earlier monophonic 33-1/3, 45 and 78 rpm disks, to cylinders, tape, and broadcast - to compact disk reissues from any of those sources.

The TNS is designed to detect the presence of a pop or click based on proprietary circuitry that evaluates what came before and after the disruption, and replaces the disruption - typically less than a thousandth of a second in duration - with a signal that approximates the music that was there. The operator is able to control the amount of noise suppression. Model 329 continues Packburn's tradition of operating real-time and reducing as much noise as possible but not at expense to the music. This makes the TNS ideal for both casual listening "set it and leave it" and fastidious transfer work. .

The Transient Noise Suppressor - Monophonic Recordings:

For monaural recordings, the TNS reduces noise two ways - in the manner described for stereophonic recordings and further, taking advantage of the

the redundancy that exists in monophonic recordings: Music signal engraved on each of the two side walls of the groove is the same. However, transient noise is caused by particles and defects that usually afflict one groove wall at a time, so surface noise is in stereo. The Packburn's transient noise suppressors, one in each channel, operate independently. Their outputs, whether the noise suppressor had to be activated or not, are added together with astonishing results.

The idea of redundant signals in early vertical-cut recordings may seem strange at first since there is only one signal engraved in the bottom of the groove. However, the vertically modulated signal is affected by disturbances in the side walls of the groove. For vertical-cut recordings, the TNS reduces noise in the manner described for stereo recordings, operating more as a "one in one" noise suppressor, however with good effect.

The Continuous Noise Suppressor:

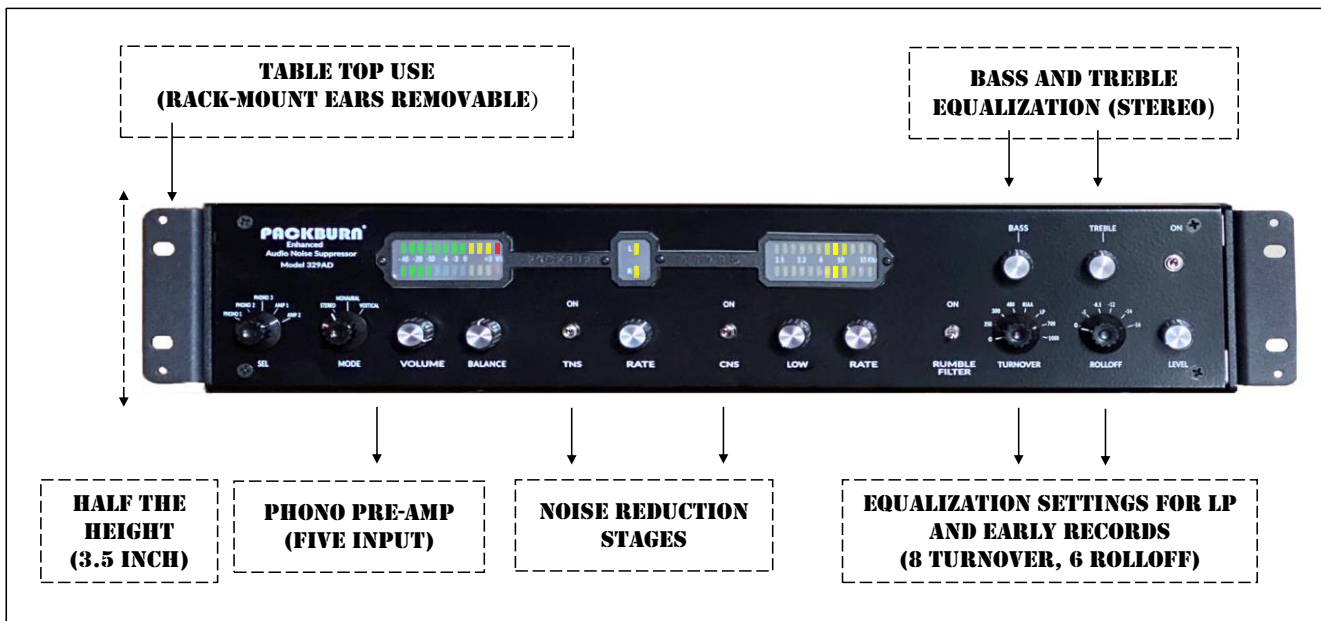
The CNS reduces audible hiss-or white noise, whatever one prefers to call it. It is a constant annoyance in just about every disk, analog tape, cylinder, wire or film recording made prior to the development of successful encode/decode systems of noise suppression, followed by digital mastering.

This noise is perceived by the human ear as being of a fairly continuous nature in contrast to the pops, ticks, and clicks of transient noise and therefore, we call this processor the Continuous Noise Suppressor. This processor comes after the TNS because it is expeditious to suppress the transient noises first. In the case of recordings containing no transient noise such as analog master tapes and copies thereof, the Continuous Noise Suppressor will be the only one needed.

The CNS is a variable low-pass filtering circuit that responds in accordance with the nature of the program material. When the program material is quiet and contains little in the way of high frequency energy, the high frequencies that the listener is aware of are almost entirely those in the noise. The cutoff frequency of the filter closes down to its lowest value. In loud and/ or brilliant passages when the signal is effectively making the noise, the cutoff frequency assumes intermediate values. The operator controls the extent to which the filter closes down and opens up, so a substantial reduction of hiss can be achieved without audible degradation of the program material and without the swishes and pumping that have been the undesirable by-product of similar devices.

Metering: VU meters each consist of twelve LED arrays. Metering takes place after the input level and the channel balance controls. TNS activity is displayed by an LED in each channel that blinks when a disturbance is being suppressed. CNS action is displayed by 12 LED arrays that display the ever fluctuating value of the cutoff frequency.

Channel balance control: the balance control operates for all media – stereo and monophonic. For monaural media it serves to optimize the performance of the TNS and also helps reduce low pitched rumble caused by the playback equipment "canting adjustment." For exacting work, the balance control (canting control) can be set by using the Mono and Vertical positions of the mode switch to audition the sum signal for lateral-cut records or the difference signal for vertical-cut records.



FACILITIES ADDITIONAL TO AND SUPPORTIVE OF THE NOISE REDUCTION PROCESSORS

Audio Noise Suppressors switches: The TNS or CNS can be switched in or out..

Stereo equalization When the mode switch is in stereo, equalization is adjusted with the bass and treble controls. The RIAA equalization curve is applied.

Monaural equalization When the mode switch is in mono or vertical, the bass and treble controls are bypassed and in their stead is therumble switch, turnover selector, and rolloff selector. These selectors pertain to recordings manufactured prior to about 1953 before the RIAA equalization curve became the industry-wide standard.

The eight position turnover selector permits selection of the commonly used bass equalization curves from the earliest recordings when the bass equalization was flat (no pre-emphasis) to the latest when the RIAA curve became the industry standard. The six position rolloff selector switch permits selection of the commonly used treble equalization curves from when the treble equalization was flat (no rolloff) also to when the RIAAcurve became the standard.

These controls can be adjusted "by ear" but for exacting work there is a table in the Model 329 Owner's Manual that provdies settings by record producer. The rumble switch reduces low pitched rumble..

SOME USERS OF THE PACKBURN AUDIO NOISE SUPPRESSOR

Owners have had this to say about the long-standing Packburn tradition –

“Simple to use....just sit back and listen!”

‘Good his, pop and click elimination!’

“Improved musical clarity!”

“The controls are easy to operate!”

“Preserves the original sound –serves archival purposes well”

“The new model is effective even on LP records.”

“There is less low frequency rumble on older records including vertical-cut records.”

APPLICATION NOTES

Stereo 33s and 45s/ vinyls: The improvement of these requires patient observation *if* they have not been abused, as these have only occasional and pops, some of which, however, can reproduce as loud as a pistol shot. The Transient Noise Suppressor reduces the pistol shots to innocuous thumps. Lesser noises are turned into slightly noticeable thuds when they are not totally eliminated. The Continuous Noise Suppressor effectively and unnoticeably reduces the hiss.

45s and Long Play Disks: You can instantly hear how the Transient Noise Suppressor reduces the crackle. Then you can adjust the Continuous Noise Suppressor for the final improvement.

78s: The success of the Audio Noise Suppressor is most spectacularly demonstrated with noisy 78 rpm disks, as these present a continuous stream of ticks, pops, etc. the suppression of which is immediately demonstrable. The same applies to excessively ticky, scratchy or dirty 45s and long play disks. You can instantly hear how the Transient Noise Suppressor reduces the crackle. Then you can adjust the Continuous Noise Suppressor for the final improvement.

45s and polystyrene long play records, with their higher hiss level, are nicely served by the Continuous Noise Suppressor.

Acetates: These can range from worn and deteriorating disks to extremely quiet, mirror-surfaced beauties. The Audio Noise Suppressor (TNS+CNS) handles the difficult ones like bad 78s, the good ones like fine long playing disks.

.Vertical-cut Recordings: This includes acoustical disks and cylinders and electrical broadcast transcriptions. The Transient Noise Suppressor has a major effect in reducing transient noises from broadcast transcriptions, acoustical disks and cylinders. The Continuous Noise Suppressor can be applied to good effect in reducing the remaining hiss.

78 Transfers to tape or long playing records: Many tape copyists and record producers mistakenly transferred 78s with the RIAA curve, which reduced surface noise but also took much of the life out of the sound of a voice or instrument. In playing back from such a source, one can restore the treble and bass equalizations using Input 4 of the Packburn switched to the RIAA position. Then use the facilities provided by the Audio Noise Suppressor to suppress the noises in the proper manner.

Analog Master Tapes and Film: The Continuous Noise Suppressor is very successful at unobtrusively reducing the hiss level of analog master tapes or copies thereof.

CDs: We claim no applicability of the Audio Noise Suppressor to CDs mastered from original digital sources. However, CDs derived from 78s, from old movie sound tracks or from master tapes that antedate the introduction of encode/decode noise reduction devices all are instances where the Audio Noise Suppressor has a role to play, whether the CD producer or the consumer

Broadcast reception in general can benefit from use of the Continuous Noise Suppressor if there is audible hiss, whether the source of the hiss is in the program material or in the conditions of the reception. Broadcasts of historical material, if equalized with the RIAA curve (as it often is) can be corrected using the fourth input of the Model 329, and transient noises can also be suppressed.

Regarding copies, In general: The Blanker has to be relied on to provide whatever transient noise suppression is to be achieved. However, it must be recognized that recordings processed into long playing disks or into radio broadcasts are subject to equalization, compression and limiting and probably are also several copying generations removed from the original. All of these circumstances can tend to soften the leading edge of a noise transient with the result that the detectability of the noise transient by the Transient Noise Suppressor is lowered. Thus, as a general rule, the Transient Noise Suppressor will be at its most effective when it can be applied to the original recording.

The Continuous Noise Suppressor will not be affected in the same way. It will just have more to do.

Record Restoration: Application of the Continuous Noise Suppressor is best deferred to the final stage of processing by those doing record restoration. In such applications, one would use the Transient Noise Suppressor at the start. After filtering, equalization, volume expansion, adding reverberation, etc., one can then use the Audio Noise Suppressor a second time, this time by-passing the Transient Noise Suppressor and using only the Continuous Noise Suppressor.

Quadraphonics — Surround Sound — Ambience Systems — Electronic Reverberation: The spatial illusion of these systems is seriously degraded when pops and "pistol shots" disclose the presence of the ambience loudspeakers. With the Audio Noise Suppressor one can even play 78s without any loss of the spatial illusion.

Audio Noise Suppressor Model 329 AD Technical Specifications

Designed for professional installations and for quality home sound systems

Power Line Voltages:	User Selectable: U.S./ Canadian 105 volts 120 volts, 50/60 Hz International: 210 volts-240 volts, 50/60 Hz
Power Consumption:	20 Watts
Size:	Width: 19" (483 mm) for rack mount, 17" (432 mm) with mounting ears removed Depth: 8" (203 mm), Height: 3.5" (89 mm).
Inputs and Outputs	RCA-type phono connectors for all signal input and output terminations. Five stereo inputs: 3 phonograph (2 MM and 1 MC), 2 high level (1 flat or RIAA switchable) Input impedance 100k Ohms (Phono inputs 50k Ohms) Output impedance 470 Ohms
Noise Suppression	Two transient noise suppressors, one in each channel, for click and pop suppression Two continuous noise suppressors, one in each channel, for hiss or white noise suppression
Stereo Equalization	Bass control, ± 10 dB at 100 Hz Treble control, ± 10 dB at 10 kHz
Monaural Equalization	Eight position turnover selector, 0 (flat), 250, 300, 400, 500 (LP), 500 (RIAA), 700, and 1000 Hz Six position rolloff selector, 0 (flat), 5, 8.5, 12, 14, and 16 dB at 10 kHz Equalization coverage includes FLAT, FFRR, AES, RIM and LP Rumble filter switch, 100 Hz corner, 12 dB/octave
Sensitivity:	With INPUT LEVEL control all the way up, a 0 VU (1.23 v.) reading of the processing level meters will be achieved by an input signal of by 0.4 v. or less from a single-ended source. Range of control of INPUT LEVEL potentiometer is 20 db. Unity gain is achieved with the Volume Control and Output Level controls set at mid-position.
Frequency Response:	(Continuous noise suppressor off and equalizations flat) 20 to 18 kHz $\pm \frac{1}{2}$ dB Continuous noise suppressor cutoff frequency range 2.5 to 28 kHz Cutoff frequency slope: approaches 12 dB per octave
Continuous Noise Suppressor Action:	The Continuous Noise Suppressor is a low pass filter. Cutoff frequency varies in accordance with the dynamics of the program material and the nature of the surface noise. Alternatively, a fixed cutoff frequency may be selected.
IM Distortion:	60 Hz and 7 kHz, 4:1 at + 4 vu (1.23v.) input: Less than .05%
Harmonic Distortion:	Less than .05%
S/N Ratio:	(Unweighted) – At least 75 dB with reference to + 12 vu (3 v.).
Warranty:	A full five year's warranty on both parts and labor.
About your Record Playback Equipment:	To take full advantage of the TNS, you must have equipment to play back discs or cylinders stereophonically

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Covered by one or more of the following US patents: 4,151,471; 4,155,041; 4,259,742; 4,322,641; 7,035,417

Foreword

PACKBURN[®] has been in business for over 30 years, inspired by the late Richard C. Burns. What got the company running was Dick's penchant for historical sound recordings (he accumulated 23,000 of them!) and his inventive playback equipment that would rescue musical nuances in a safe and effective manner from the assault of unwanted noise. Our modest goal was to further improve the sound quality of our personal record collections but it was quickly discovered that our noise suppressor was of interest to others. Our founding principles of safe noise reduction and ease of operation are still alive and carry into our latest patents and our Model 329AD "silver bullet" which, for the first time, includes a pre-amp. The pre-amp is combined with new and improved audio noise suppression. The model 329AD is aimed toward vinyl record enthusiasts, but those interested in the older formats (78's, cylinders, etc.) will find it to be a more powerful noise reducer.

The noise suppression includes a TNS (transient noise suppressor) for suppression of ticks and pops, and a CNS (continuous noise suppressor) for suppression of hiss and white noise. Both types of noise are commonplace in historical sound recordings. Being "real time" audio noise suppressors, they are perpetually on guard, acting moment by moment to automatically suppress noise as it occurs.

Owners usually get the unit quickly connected and turned on and proceed to "enjoy". For casual listening you will probably develop settings that apply to a given recording format. For meticulous copying of records, you will want to check the settings for each individual recording. The instruction manual describes how to use the Audio Noise Suppressor with LP's, of course, and also a wide variety of historical sound recording media.

We appreciate your purchase of our product, and we strived to make your unit work for you as well as it has for us during extensive bench testing, one week run-in, and a listening session with test records.

Wishing you pleasurable listening!

Thomas N. Packard

President

System Installation

Turntable For playback of all source material and speeds, even for monophonic material, a stereo cartridge should be used for optimum performance of the Packburn's audio noise reduction stages. For those using the PACKBURN for playback of 78 RPM records, stylus suggestions are provided on p. 17.

Optional Preamplifier Customers who want to use their own stereo preamplifier connect a turntable to their preamp (in phono playback mode) to one of the AMP inputs of the Packburn. AMP1 accommodates preamps having either flat equalization or factory-fixed RIAA equalization (in phono playback mode). AMP2 accommodates a second pre-amp having just flat factory fixed equalization. For either of these inputs, even when the source material is monophonic, the customer's preamp should be set to play in stereo, for optimum performance of the PACKBURN'S audio noise reduction stages.

Customers who do not want to use a pre-amplifier connect their turntable directly to one of the PHONO inputs of the Packburn where an internal preamp is available. The Packburn has three PHONO inputs - one for a turntable having a moving coil (mc) cartridge and two for turntables having moving magnet (mm) cartridges.

High Level Playback Equipment A CD player connects directly to the AMP1 input (set to the RIAA/ CD position). This gives optimum performance of the Packburn's audio noise reduction stages. For stereo CD's (with the Packburn in stereo), there will be overall flat equalization, adjustable by Packburn's bass and treble controls. For monaural CD's (with the Packburn in mono), the bass and treble controls are bypassed, and instead, there is adjustable equalization using the Packburn's turnover and rolloff controls.

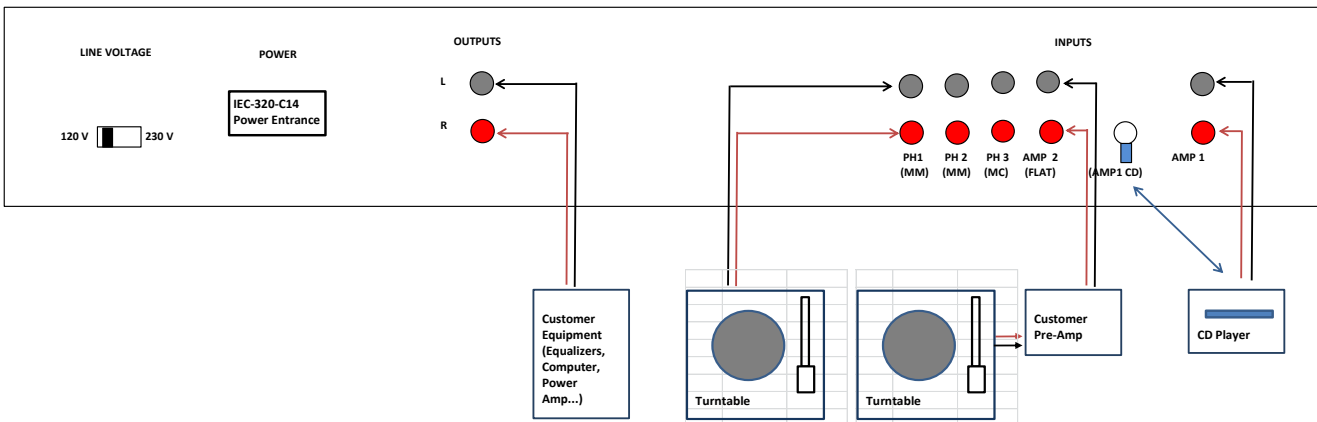
Output Equipment The output of the PACKBURN can be connected to signal processing devices such as equalizers, filters and sonic enhancers for further improving the signal that is being processed, and alternatively to recording devices, computers, or power amplifiers, The Packburn installs in the audio system much as one would install a stereo equalizer.

Rear Panel Features

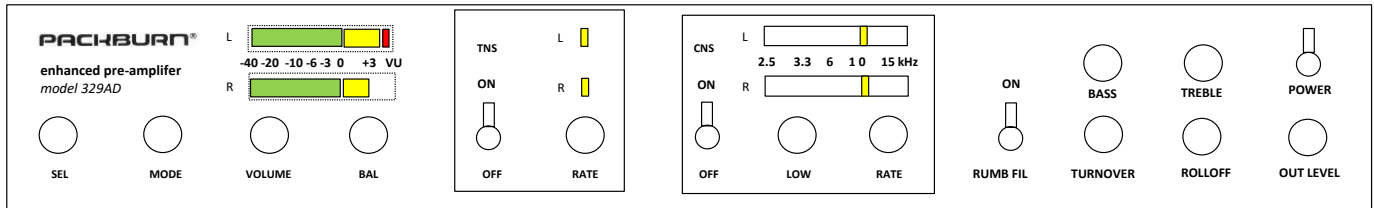


LINE VOLTAGE	Set to the proper voltage before you do anything else!
POWER	Power Entrance IEC-320-C14
INPUTS	<p>Phono 1 For a moving magnet-type (mm) cartridge</p> <p>Phono 2 for a moving magnet-type (mm) cartridge</p> <p>Phono 3 For a moving coil -type (mc) cartridge</p> <p>Amp 1 For a CD player, phono pre-amps having flat or RIAA equalization, high level signal sources</p> <p>Amp 2 For phono pre-amps having flat equalization only</p> <p>AMP 1 switch Flat setting for customer pre-amp in its phono setting having RIAA equalization RIAA setting for customer pre-amp in its phono settings having flat equalization RIAA setting for CD player, cassette player, or other high level sound source</p>
OUTPUTS	

System Hookup Options



Front Panel Features



Amplifier	
SELECTOR	<ul style="list-style-type: none"> Phono 1 For a moving magnet-type (mm) cartridge Phono 2 for a moving magnet-type (mm) cartridge Phono 3 For a moving coil-type (mc) cartridge Amp 1 For a CD player, phono pre-amps having flat or RIAA equalization, high level signal sources Amp 2 For phono pre-amps having flat equalization only
MODE	<ul style="list-style-type: none"> Stereo For stereo records, vinyl records, tapes, stereo signal sources Monaural For early LP records, 78 rpm records, lateral-cut records Vertical For hill-and-dale, cylinders, vertical cut-records
VOLUME	Music or speech should have peak readings at about or slightly above 0 VU. If just ticks cause the red LED to light, that's okay. The meters have approximately 6 dB headroom. The input level control has a 20dB range.
BALANCE	"Fine tunes" the level match between the left and right channel levels ± 6 dB. Balancing is especially important for a monaural program source to minimize rumble.
TNS on/off	Transient Noise Suppressor for tick and pop suppression when "on"
RATE	Adjusts the degree of suppression, displayed on left channel (L) and right channel (R) LEDs.
CNS on/off	Continuous Noise Suppressor for hiss and white noise suppression when "on"
LOW	Sets the lowest frequencies to be suppressed, indicated on LED display
RATE	Adjusts the degree to which higher frequencies are "let through", in response to the music
Filters	
MODE in Stereo:	BASS and TREBLE
MODE in Mon or Ver:	RUMBLE, TURNOVER (8 position including flat, and ROLLOFF (6 position including flat)
OUTPUT LEVEL	For all modes: Adjusts the output gain without affecting the VU meter readings, by ± 10 dB.

General Description of the Controls

(Balance) matches the levels of the left and right input signals, and for monaural or vertical records, adjusting it is important for optimum noise suppression. Turn the TNS and CNS off. For monaural records, turn the mode switch to “vertical” and set the balance control to the music null (cancellation of the music). If the transient noise (ticks and pops) is canceling at the same time, make sure the phono cartridge and (if there is one) the pre-amp between the turntable and the Packburn are stereo. Also, make sure the treble and bass control settings in that external pre-amp are set the same. “Balance” corrects up to a 6 dB mismatch between the input signal levels.

(TNS Rate) increases the sensitivity of the transient noise suppressor for reducing ticks and pops when it is adjusted clockwise. As the sensitivity increases, the L, R lights increasingly flicker, indicating that the left and right input signals are being independently noise suppressed. These lights are conservative. It is normal for them to respond to louder passages of music. A 3:00 control setting is a good starting place for most records in fair condition. For 78 rpm records with hiss or long playing records with scratches, higher settings are often beneficial.

(CNS Low) sets the lowest frequency in the input signals to be noise filtered. When the CNS rate control is set to 8:00 (fully counter-clockwise), the ‘low’ control operates like a treble control and is set to where the hiss is removed. The setting is best made during quiet passages of music. The setting is displayed on the frequency meter. Typical settings are 8:00 to 10:00.

(CNS Rate) sets how the CNS should react to louder or more brilliant passages of music. The control is adjusted in the clockwise direction until these passages are not dulled. For records in fair condition, the frequency meter should display a reading of 10 to 15 kHz during loud or brilliant passages. It is okay for the frequency meter to go off scale. The optimum setting of the ‘Rate’ control may require ‘low’ to be increased from its initial setting. Typical ‘Rate’ control settings are 10:00 and 12:00.

(Bass) boosts or attenuates low frequencies by 10 dB at 100 Hz. The bass control is operative in stereo mode, bypassed in monaural and vertical modes.

(Treble) boosts or attenuates low frequencies by 10 dB at 10 kHz. The bass control is operative in stereo mode, bypassed in monaural and vertical modes.

(Rumble Filter) removes low frequency noise typically caused by record warpage.

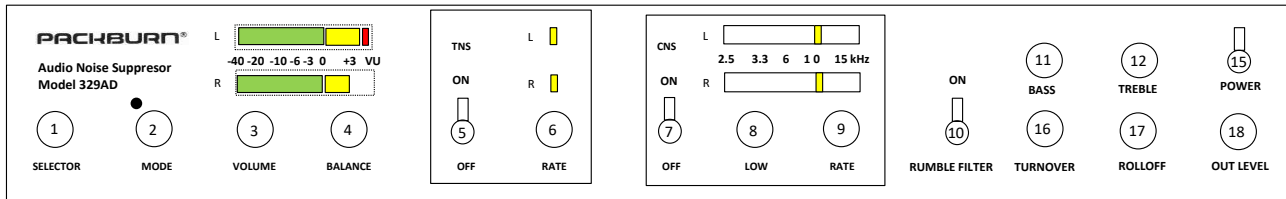
(Turnover) provides the most common eight low frequency (bass) equalization curves for playback of 78, monaural 45 and 33-1/3 RPM phonograph records, and also for cylinders. Refer to *Equalization Settings*, pp. 21-3. For CDs, magnetic tape, video, film, broadcast or other media, set the turnover to "RIAA". If you change the turnover setting, it might be necessary to change the input level setting.

(Rolloff) provides the six most common high frequency (treble) equalization curves for the playback of 78, 45 and monaural 33-1/3 RPM phonograph records, and also cylinders. Refer to *Equalization Settings*, pp. 21-3. For CDs, magnetic tape, video, film, broadcast or other media, set rolloff to "RIAA". If you change the rolloff setting, it might be necessary to change the CNS control settings.

(VU Meters) follow the volume, balance, TNS, and equalization and bass/treble controls. If you are using a pre-amplifier to provide signal to the Packburn, it should be adjusted so the VU Meters yield approximately equal readings on the music. The Volume control should be adjusted so the peak readings of the program material (music or speech) reach, or are slightly above 0 VU. An occasional red flicker is okay. If ticks and pops causes the meter to go off scale, and if they drive one channel into the red more so than the other, do not worry about it if the program levels are correct. When there are loud ticks, the performance of the TNS is noticeable in the VU meters. The meters have roughly a 10 dB headroom above 0 VU.

STEREO Source Material Playback Instruction

33-1/3 and 45 RPM Records, Vinyl Records, Stereo Cassette Tapes, Stereo Film, Stereo CD's



Rear Panel

Set to the proper line voltage (120/240 VAC) before you do anything else!

Front Panel

18	Rotate Output Level fully counter-clockwise
15	Power switch on
1	Selector to the input in use
2	Mode to Stereo (enables bass and treble, and disables rumble filter, turnover and rolloff controls.)
3	Volume- adjusts VU meter readings. Yellow is ok, just cautionary. Red is ok on ticks and momentary flickering on music.
4	Balance to match left and right signal levels. If a customer is providing signal to the Packburn through their pre-amp, this might require adjustment of its balance control.
11	Bass boost or cut as desired (center position = flat)
12	Treble boost or cut for noise suppression
18	Output Level adjust again, this time to the desired listening level.

Suppression of ticks, clicks and pops

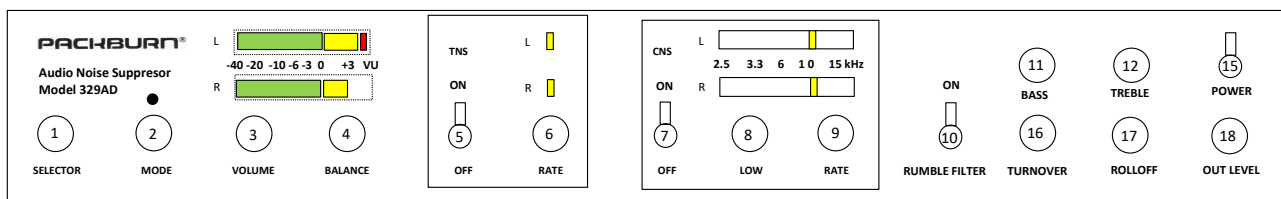
5	TNS on. (Transient Noise Suppressor).
6	TNS Rate turn clockwise, watching the LED display, listening for noise suppression.

Suppression of hiss or white noise

7	CNS on. (Continuous Noise Suppressor).
9	CNS Rate full counterclockwise
8	CNS Low control clockwise, listening until the noise level increases
9	CNS Rate turn clockwise, just before the noise is not masked by the music
8	CNS Low control adjust again, if necessary, for "evenness" of sound

MONAURAL Source Material Playback Instruction

Early 33-1/3 and 45 RPM Records, 78 RPM Records, Lateral Cut 78's, Monaural Film, Mono CD's



Rear Panel

Set to the proper line voltage (120/240 VAC) before you do anything else!

Front Panel

18	Rotate Output Level fully counter-clockwise
15	Power switch on
1	Selector to the input in use
2	Mode to Mono (enables rumble filter, turnover and rolloff, and disables bass and treble controls.)
3	Volume- adjusts VU meter readings. Yellow is ok, just cautionary. Red is ok on ticks and momentary flickering on music.
16	Turnover set according to a table on pp. 21-3.
17	Rolloff set according to a table on pp. 21-3.
10	Rumble Filter for excessive bass (warped records).
18	Output Level adjust again, this time to the desired listening level.
2	Mode to Vertical, for setting Bal 4 for the best signal cancellation. If a customer is providing signal to the Packburn through their pre-amp, this might require adjustment of its balance control. Its bass and treble controls should be adjusted for "flat"
2	Mode back to Mono .

Suppression of ticks, clicks and pops

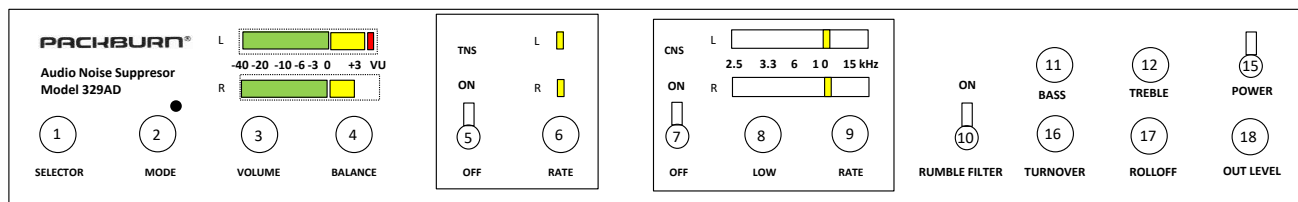
5	TNS on. (Transient Noise Suppressor).
6	TNS Rate turn clockwise, watching the LED display, listening for noise suppression.

Suppression of hiss or white noise

7	CNS on. (Continuous Noise Suppressor).
9	CNS Rate full counterclockwise
8	CNS Low control clockwise, listening until the noise level increases
9	CNS Rate turn clockwise, just before the noise is not masked by the music
8	CNS Low control adjust again, if necessary, for "evenness" of sound

VERTICAL CUT Source Material Playback Instruction

Edison Cylinders and Diamond Discs, Hill and Dale, Pathe', Vertical Cut Records



Rear Panel

Set to the proper line voltage (120/240 VAC) before you do anything else!

Front Panel

18	Rotate Output Level fully counter-clockwise
15	Power switch on
1	Selector to the input in use
2	Mode to Vertical (enables rumble filter, turnover and rolloff, and disables bass and treble controls.)
3	Volume- adjusts VU meter readings. Yellow is ok, just cautionary. Red is ok on ticks and momentary flickering on music.
16	Turnover set according to pp. 19- 20, 23.
17	Rolloff set according to pp. 19-20, 23..
10	Rumble Filter for excessive bass (warped records).
18	Output Level adjust again, this time to the desired listening level.
2	Mode to Mono, for setting Bal 4 for the best signal cancellation. If a customer is providing signal to the Packburn through their pre-amp, this might require adjustment of its balance control. Its bass and treble controls should be adjusted for "flat"
2	Mode back to Vertical .

Suppression of ticks, clicks and pops

5	TNS on. (Transient Noise Suppressor).
6	TNS Rate turn clockwise, watching the LED display, listening for noise suppression.

Suppression of hiss or white noise

7	CNS on. (Continuous Noise Suppressor).
9	CNS Rate full counterclockwise
8	CNS Low control clockwise, listening until the noise level increases
9	CNS Rate turn clockwise, until the noise is not masked by the music
8	CNS Low control adjust again, if necessary, for "evenness" of sound

Playback of Other Recorded Media

Compact Discs

CDs derived from 78s, from old movie sound tracks or from master tapes that antedate the introduction of encode/decode noise reduction devices are some examples of where the Packburn has a role to play, in either of these two cases:

- When stereo or monophonic CDs are played, the CD player is plugged into AMP1 with the rear panel switch in the RIAA position as indicated on p. 4, and the Mode switch is in Stereo.
- There may be occasions when it is obvious that the copyist who had transferred the 78 record to the CD had wrongly used the RIAA playback curve – perhaps that was the only equipment that was available. The result is that the bass frequencies on the CD are noticeably boomy and high frequencies noticeably lacking. In those instances, the CD player is plugged into AMP1 with the rear panel switch in the Flat position (or in AMP2) and the Mode switch in Monaural. The CD can now be properly re-equalized using the Packburn's Turnover and Rolloff controls.

Cassettes, 8-Tracks, and Reel-to-Reel Magnetic Tapes

Tape copies dubbed from 78s, old movie sound tracks or earlier generation tapes that antedate the introduction of encode/decode noise reduction devices are some examples of where the Packburn has a role to play, in either of these two cases:

- When stereo or monophonic tapes are played, the CD player is plugged into AMP1 with the rear panel switch in the RIAA position as indicated on p. 4, and the Mode switch is in Stereo.
- There may be occasions when it is obvious that the copyist who had transferred a 78 record to tape had wrongly used the RIAA playback curve – perhaps that was the only equipment that was available. The result is that the bass frequencies on the tape are noticeably boomy and high frequencies noticeably lacking. In those instances, the tape player is plugged into AMP1 with the rear panel switch in the Flat position (or in AMP2) and the Mode switch in Monaural. The tape can now be properly re-equalized using the Packburn's Turnover and Rolloff controls.

Sometimes the tape was generated from a live concert, or with involvement of an “acoustic link”, such as from a loudspeaker source “through air” to a microphone. The TNS and more likely the CNS might be able to reduce ambient noise.

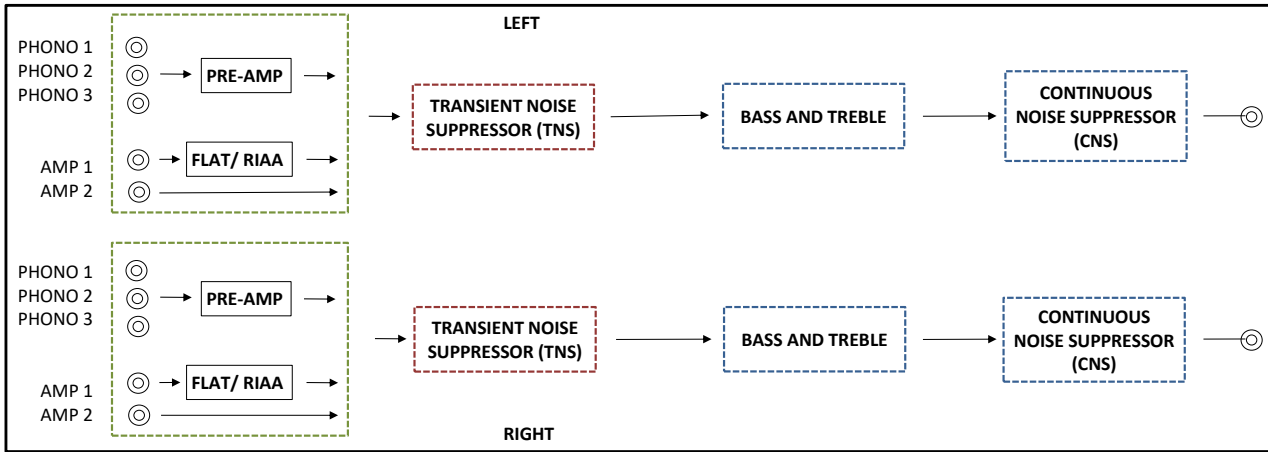
Film Recordings, Wire Recordings

Although we do not have experience with processing either of these media, the TNS should be able to reduce transient noise and the CNS should be able to reduce continuous noise.

Technical Descriptions

Mode Switch in Stereo

33-1/3 and 45 RPM Stereo Records, Vinyl Records, Stereo Cassette Tapes, Stereo Film, Stereo CD's



TNS (Transient Noise Suppressor)

Impulse noises on records are characterized by a high amplitude and a short duration. Their duration is so short that it is chiefly by virtue of their high amplitude that they are perceived as acutely as they are. The TNS finds these impulses faithfully and replaces them with a reconstruction of the music that they obliterated, reducing these noises to inaudibility or to a sufficiently low value so that they no longer constitute an annoyance.

The TNS is designed for maximum preservation of the program material and the ability to cope with high rate of incidence of noises, even those in 78 rpm records. The (TNS) RATE control establishes the sensitivity threshold.

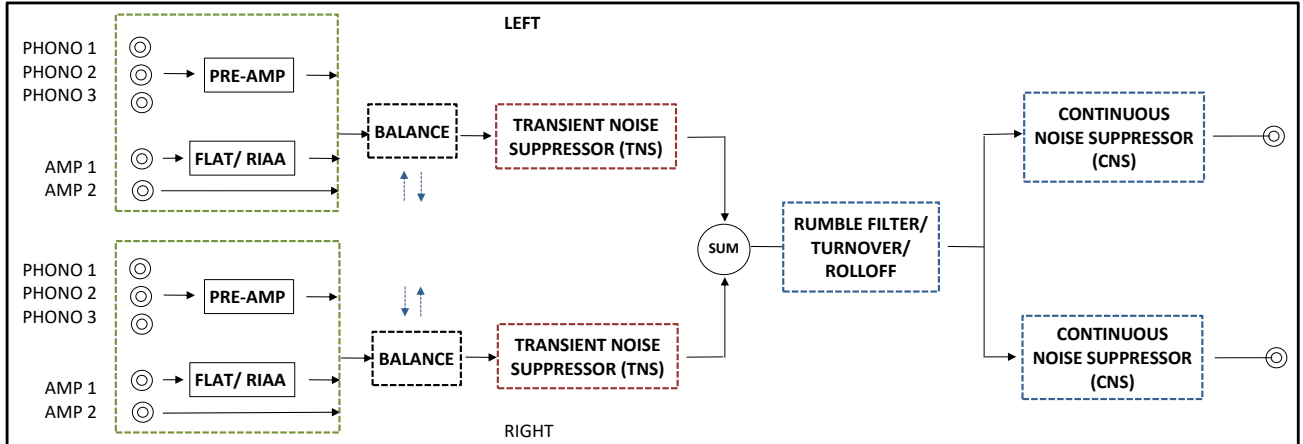
CNS (Continuous Noise Suppressor)

The Continuous Noise Suppressor is designed to reduce high frequency noises of a continuous nature (hiss). It is, basically, a dynamic low-pass filter with a variable cutoff frequency between 2.5 kHz and 16 kHz. Thus, its action is confined almost exclusively to the overtone region of the musical spectrum, as its lowest cutoff frequency exceeds the pitch of the highest note of most musical instruments. The cutoff frequencies in the left and right channels match each other so as not to affect the stereo imagery. The rolloff approaches 12 decibels per octave.

The cutoff frequency is determined moment-by-moment by the relation of the velocity component of the total local signal-plus-noise to the peak local signal-plus-noise in a selected octave bandwidth. As evidenced by the frequency meter, The CNS is able to distinguish a musical transient which causes the cutoff frequency to abruptly rise) and a noise transient where the cutoff frequency usually remains unchanged.

Mode Switch in Monaural

Early 33-1/3 and 45 RPM Records, 78 RPM Records, Lateral Cut 78's, Monaural Film, Mon CD's



Balance Control Adjustment

When monaural records such as listed above are played with a stereo phono-cartridge, the music remains monaural of course, since (ideally) the groove width does not vary, and the left and right output signals are derived off the right and left groove walls as they meander back and forth. To help set the balance control, the mode control is set in 'Vertical', which inverts the signal in just the right channel, as shown in the next page. When the music signals are in balance, they are equal but opposite and so when summed, they cancel each other at a "null" position. Balancing helps reduce rumble due to up-down motion of the stylus (the vertical component) brought on by record warpage, and helps the noise suppressors work optimally.

TNS (Transient Noise Suppressor)

Transient noise is caused by random imperfections in the groove walls, each resulting in an impulse signal. Each is of short duration, so it is chiefly their high amplitudes that make them so offensive. The TNS finds these impulses faithfully and replaces them with a reconstruction of the music that they obliterated, reducing these disturbances usually to inaudibility.

If imperfections occur in the left and right groove walls at the same time, the TNS in each channel both act. More often than not, the imperfection affects only one groove wall at a time, resulting in a transient signal in just one channel and just one TNS acting. When the two signals (music signal and reconstructed signal) get mixed after the TNS filters, the result is the best overall recreation of the music.¹

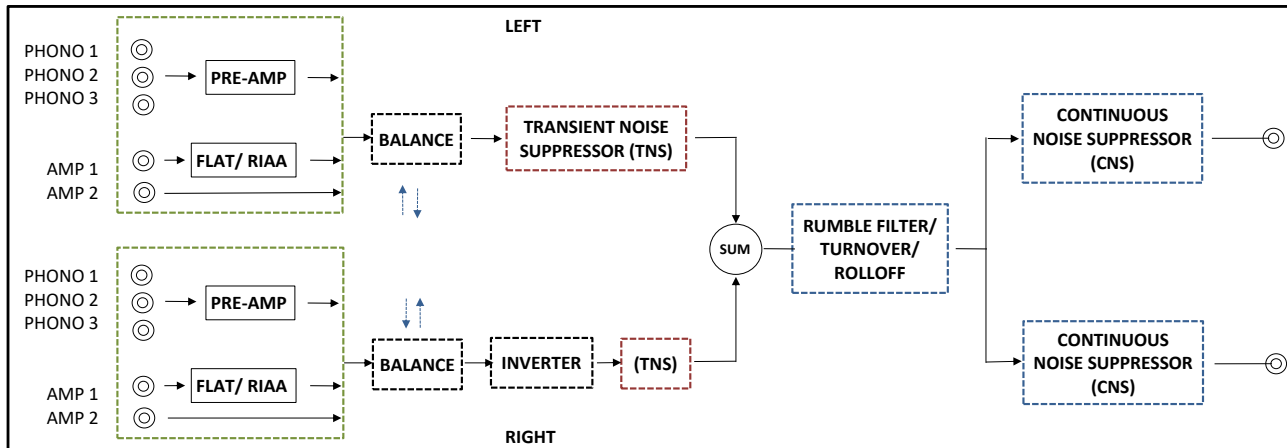
The TNS is designed for maximum preservation of the program material and the ability to cope with even the high rate of incidence of noises on 78 rpm records. The TNS Rate control establishes the sensitivity threshold. For optimal playback of early LP's and the older formats, see p. 15.

CNS (Continuous Noise Suppressor) See description in the preceding page.

¹ Owners of earlier Packburn units will recognize that this is akin to what was referred to as "the Switcher."

Mode Switch in Vertical

Edison Cylinders and Diamond Discs, Hill and Dale, Vertical Cut Records



Balance Control Adjustment

In vertical-cut records, the music signal relies on up-down motion of the stylus, as opposed to a back-and-forth meander of the groove. To help set the balance control, the mode control is set in 'Lateral', which removes the inverter in the right channel as shown in the preceding page. When the music signals are in balance, they are equal but opposite - when summed, they cancel each other at a "null" position.

Balance should be carefully adjusted for the best cancellation of the lateral component. This process is referred to as "canting". Comparing the monaural and vertical positions of the Mode switch can help you determine the best setting for the Balance control. The optimum setting can be different from record to record.

TNS (Transient Noise Suppressor)

Transient noise is caused by random imperfections in the groove walls, each resulting in an impulse signal. Each is of short duration, so it is chiefly their high amplitudes that make them so offensive. The TNS finds these impulses faithfully and replaces them with a reconstruction of the music that they obliterated, reducing these disturbances to inaudibility.

The TNS is designed for maximum preservation of the program material and the ability to cope with even the high rate found in vertical-cut records and cylinders. The TNS Rate control establishes the sensitivity threshold. For optimal playback of vertical cut records, see p. 15.

Vertical-cut material differs fundamentally from lateral-cut records in that the signal is recorded in the bottom of the groove rather than on the two sidewalls. Thus there are not two legitimate signal channels for the TNS to choose from. More often, the TNS in both channels act at the same time, however, there are instances when just one TNS acts. And when that happens, the two signals (music signal and reconstructed signal) get mixed after the TNS filters for best overall recreation of the music.

CNS (Continuous Noise Suppressor) See description on p. 12.

Optimal Playback of Phonograph Records

A. Cleaning (All speeds)

Optimal reproduction of a phonograph record requires that it be clean. We are not able to recommend one cleaning method or product over another, but in general whenever cleaning, "caution" is the word: Some cleaning solutions may be totally safe for one kind of record surface, but damaging to another. For example, a mild detergent and water is safe for vinyl (used with a gentle brush), and shellac, but deleterious to cylinders and Diamond Discs. If the record appears to have deteriorated, consider creating a "safety dub" before attempting to clean. If you have a record of similar condition but of lesser value, you might want to use it for practice. Record labels should not be unduly exposed to the cleaning solution, the inks and the adhesives being at risk.

A web search will show much thought has been given to cleaning, options ranging from household supplies (mild detergent and distilled water) to methods employing cleaning machines and proprietary cleaning solutions. If you are seeking expert guidance, you might consult an archive, preservationist, or the Association for Recorded Sound Collections (ARSC.)

B. Centering and Flatness (78's)

It has been our experience that most low-frequency thumps in the reproduction of the earlier formats (78s) are due to warped or off-center records. In addition, off-centeredness may cause a once-per-revolution swish. Centering and flattening of the disc are recommended for the elimination of these noises. The Rumble Filter will further reduce thumps and often, the CNS Filter will further reduce swish.

C. Optimum Stylus (78's)

It has been our experience that conical styli reproduce some records with less hiss than do elliptical styli although with louder reproduction of the ticks. Since the Packburn Audio Noise Suppressor suppresses the ticks, some owners have found that the conical stylus is optimal in those cases where harmonics greater than about 7 to 8 kHz are not present (early acoustical recordings, for example). The elliptical stylus, having a superior resolving power, is best when high frequency harmonics and musical transients are present (electrical recordings and late acoustical recordings.) Some styli, whether conical or elliptical, are truncated so the tip of the needle does not become a noise source, riding on the bottom of the groove.

The width of the groove in 78s is not standard, resulting in an array of sizes for optimal playback. In most cases, a 1.1 mil stylus works for LP's and 45's and a 2.7 mil stylus works for 78's. For exacting listening, consult dealers. Sometimes when a record is worn, an over-sized needle is optimal, riding in the groove above the damage.

D. Vertical Component Optimization (more-so 78's) (Listening to the null when the mode switch is in vertical)

The earliest formats (e.g. 78's) are particularly affected by record warpage, off-center playback, surface unevenness and by signal components introduced by tracking error and tracing error including "pinch effect". Listening to the null with the (TNS, CNS, and Rumble) filters all off, there will be least music and least rumble when your equipment is properly aligned, and the correct stylus size is in use.

Recommendations for Preserving Perishable Media

The Packburn versus Computerized Noise Reduction Systems

Those who own computerized noise reduction systems have given us these reasons for owning a Packburn:

- another “tool in the toolbox”
- a convenient way to just sit back and listen at times
- a way to optimize playback (e.g. stylus selection)
- a quick way to identify what should be digitally transferred.

First Generation Media

First generation media with limited life expectancy are often transferred in as close to their original forms as possible to non-perishable, often digital media for archiving. The Packburn's Mode switch will help reproduce first generation discs or cylinders with optimal stylus, cleaning, anti-skating adjustment, record centering or disc flattening, or magnetic tape with optimal head alignment. We suggest that whenever possible, both monaural and stereo media be transferred in stereo. Later when the transfer is played back, the signal can be noise-reduced through the Packburn or a future device that takes advantage of this “built-in” signal redundancy, for noise reduction.

Magnetic Tape

If the perishable medium is monophonic tape, azimuth alignment of the tape head is critical. To perform the alignment, use either a phase monitor oscilloscope (next page) or audition the difference component (Mode switch in Vertical).

If the tape happens to be a second or third generation, it must be recognized that the intervening work could have involved a lot of equalization, compression or limiting.

Digital Transfers

Carefully made stereophonic transfers of monophonic discs or cylinders using digital methods can provide good results. Since the transfer is in stereo, the TNS stage will be used to best advantage.

D. Half Speed Transferring

If you have to play a record at half speed or at some other speed considerably removed from normal to make the transfer, it is recommended that the transfer be played back on pitch into the Audio Noise Suppressor. This takes advantage of optimized time constants in the noise suppression circuits.

Trouble - Shooting Procedures

Problem	Things to Check
There is input signal but no output signal.	<ul style="list-style-type: none"> • Did input and output cables get swapped? • Is a low level phono cartridge (mc cartridge) being plugged into Phono 1 or Phono 2?
The amber TNS lights are lit steadily and brightly and there is no output signal.	<ul style="list-style-type: none"> • A high level cartridge (mm cartridge) was plugged into Phono 3. • A pre-amp or CD player was plugged into Phono 1, 2, or 3. <p>The Packburn has muted a seriously overloading input signal (way beyond the red.) To “reset” the Packburn, first re-connect the input cable to where it belongs and turn down the Packburn’s volume control. Then turn the Packburn’s power switch off for a few seconds and back on.</p>
The amount of bass and treble sound okay when the turntable is plugged to a Packburn’s phono input but not when the signal is fed through your pre-amp to one of the Packburn’s amplifier inputs.	<ul style="list-style-type: none"> • Plug the pre-amplifier into Amp 1 and set the rear switch of the Packburn to “RIAA” when your pre-amplifier has RIAA equalization or “Flat” when it has flat (or no) equalization. • Plug only a pre-amplifier with flat equalization into Amp 2 of the Packburn (the rear switch has no effect on Amp 2.)
When the balance control is being optimally set for monaural records (p.) both the ticks and the music are nulling.	<ul style="list-style-type: none"> • Nulling of the ticks indicates that either the phono cartridge or a pre-amp you are using to feed signal to the Packburn is monaural. A monaural signal to the Packburn will work however a stereo input signal is optimal.. See p. 3.
When adjusting the balance control there is not a distinct null in the music.	<ul style="list-style-type: none"> • Turn the Packburn mode switch to stereo and make sure there is input signal on both VU meters! • The record being played could be a dubbing. - So be it! • If using a pre-amp to provide signal to the Packburn, its left and right channel bass and treble controls may not be set the same. • The phono cartridge might not be properly aligned.
There is not much action of the frequency meter, even with the CNS rate fully clockwise.	<ul style="list-style-type: none"> • This can arise when you are have connected a pre-amp with flat equalization into the Packburn’s Amp 1 input and the rear switch is accidentally set to “RIAA.”
There is an excessive amount of white noise/ hiss.	<ul style="list-style-type: none"> • This can arise when you are have connected a pre-amp with flat equalization into the Packburn’s Amp 1 input and the rear switch is accidentally set to “RIAA.”

Equalization Settings

(All formats)

Stereophonic recordings are played with the Mode switch in stereo, where the Turnover and Rolloff selectors get bypassed. Instead, the RIAA curve is engaged (by that time, it became the standard curve), and bass and treble controls are provided.

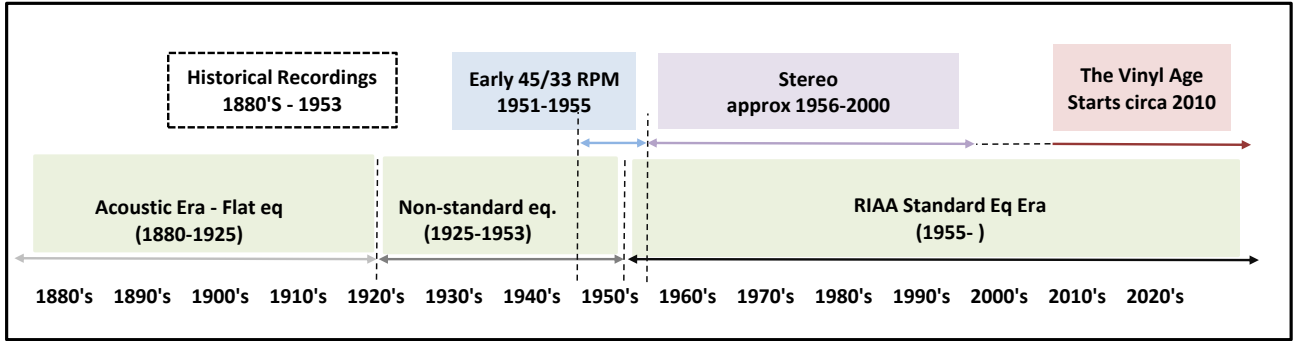
Monophonic and Vertical positions of the mode switch bypass the bass and treble controls, and enable the Turnover and Rolloff controls. They afford a variety of equalization curves, the RIAA curve not having yet been adopted as the standard. If an AMP input of the Packburn is used, the installation instructions on p. 3 must be followed for the turnover and rolloff controls to operate properly.

The equalization curve when the record was manufactured had a characteristic “bass-turnover frequency” and “treble pre-emphasis.” Companies chose curves that made the playback of their records on their own equipment sound the best. During playback, it was intended that there be an inverse curve to the one that had been recorded, restoring the original signal.

Turnover, also referred to as “bass-turnover”, is the attenuation of low frequencies during record manufacturing to limit groove modulation. Bass limiting was introduced with playback equipment in mind to maintain satisfactory groove tracking and to reduce record wear. Most of the published recording curves for 78 rpm records indicate that the bass attenuation (or "constant amplitude") portion of the curves had a 6 dB/octave slope. During playback, the frequencies below the turnover setting are accentuated to restore the bass signal. The scale on the TURNOVER control provides the frequencies in Hz where the bass level is boosted 3 dB.

Rolloff, also referred to as “treble pre-emphasis”, is the accentuation of high frequencies during record manufacturing. During playback, the high frequencies are “rolled off” to restore the treble characteristic whereas high frequency noise becomes attenuated. Treble pre-emphasis appears to have been first used for reducing noise in broadcast transcriptions. It was eventually applied to 78 rpm records and to all long playing records. The historical drawback was that millions of record players were in service by then having a permanent flat treble characteristic that caused the later recordings to sound shrill. During playback, the rolloff slope is 6 dB/octave except for the 8.5 dB setting where the slope is 2.5 dB/octave. The scale on the ROLLOFF control provides the attenuations (in Decibels) occurring at 10 kHz.

Equalization Timeline



Stereo (and Vinyl) - When the mode switch is set to stereo, RIAA turnover and rolloff is automatically selected.

Early monaural 45's and 33-1/3 speed records from about 1951 until 1955 - The mode switch is set to Monaural. Turnover and Rolloff are set using Tables 1 and 2. The RIAA equalization curve became the standard in 1953. Thus for monaural records after 1955, Turnover and Rolloff should be set respectively to 500Hz and -14dB.

Historical recordings from 1925 until 1953 – The mode switch is set to Monaural or Vertical, whichever the recording format requires. Turnover and Rolloff using Tables 1 and 3. The year 1925 marks the usage of microphones and what has been referred to as 'electrical recordings.'

Historical recordings before 1925 - The mode switch is set to Monaural or Vertical, whichever the recording format requires. Turnover and Rolloff are set respectively at 0 Hz and 0 dB, i.e., there "flat positions": Equalization curves were not yet introduced.

Editorial Comments

The need to use equalization curves for proper playback of electrical records has never been controversial, however, there is still some disagreement as to what curve should be used on what company's records made at what time. In addition, the equalization curves may be one among several factors that transformed the bass and treble response during the recording process. For reasons such as these, the equalization tables should be treated as a good starting place. The trained ear might be the best final judge.

Regarding acoustic discs and cylinders, some maintain they should be played back "flat" since electrical manipulation of the recording characteristic was unknown in the era of acoustical recording. When played in this manner there is almost non-existent bass due to the inherent mechanical equalization of the primitive recording process. Others want to hear more bass. Using a 250 Hz turnover does not exactly reverse the mechanical equalization but may offer a better starting place. Some use a rolloff of 5 dB to reduce surface noise.

Table 1. Equalization Curves by Name

Name	Turnover (Hz)		Rolloff (dB)	
	Published Setting	Nearest Packburn Setting	Published Setting	Nearest Packburn Setting
AES	400	400	12	12
FFRR (1949)	250	250	5	6
FFRR (1951)	300	300	14	14
FFRR (1953)	450	500	11	12
LP/ COL	500 (LP)	LP	16	16
NAB	500	500	16	16
Orthophonic (RCA)	500	500	11 (8.5)	12 (8.5)
629	629	700		
RIAA	500	500	13.7	14

Some of these published curves additionally include a low frequency "shelf" below which the attenuation in the recording process is leveled off. The benefit is that the corresponding leveling in the playback equalization curves reduces turntable rumble. The Columbia LP shelf is 100 Hz whereas the RCA Orthocoustic, RCA Orthophonic and RIAA shelves are 50 Hz.

Table 2. Equalization Settings
(Early 45 RPM and 33-1/3 RPM Monaural Records)

45 RPM Labels	Turnover Freq. (Hz)	Rolloff at 10 kHz (dB)	33-1/3 RPM Labels	Turnover Freq. (Hz)	Rolloff at 10 kHz (dB)	33-1/3 RPM Labels	Turnover Freq. (Hz)	Rolloff at 10 kHz (dB)
Columbia	500	16	Colosseum	400 LP	12 16	MGM	500	12
Decca	750	16				New Records	750	16
Mercury	400	12	Columbia	LP	16	Oceanic	LP	16
MGM	500	12	Concert Hall	400 LP LP	12 16 8.5	Okeh	300	8.5
RCA Victor	800	10	Cook	500	12	Oxford	750	16
33-1/3 RPM Labels						Odeon	300	8.5
			Coral	400	12	Parlophone	300	8.5
Allegro	750	16	Decca (FFRR '51) (FFRR '53)	400 LP 300 450	12 16 14 14	Period	500	16
Allied	500	16	Dial	750	16	Philharmonia	400	12
American Record Society	500	12	Electra	630	16	Polydor	300	8.5
Angel	500	12	EMS	400	12	Polymusic	500	16
Arizona	400	12	Epic	750	16	Rachmaninoff	750	16
Atlantic	500	16	Esoteric	500 400	12 12	RCA 1948 1949 1953	500 500 500	10.5 12 14
Audio Fidelity	500	16	Festival	750	16	Remington	500	16
Bach Guild	750	16	Folkways	630	16	Renaissance	750	12
Banner	750	16	Good Time Jazz	400	12	Stradivari	750	16
Bartok	630	16	Handel Society	750	16	Telefunken	400	0
Boston	630	16	Haydn Society	750	16	Ultraphone	400	0
Blue Note Jazz	400	12	HMV	800	10	Urania (Most) (New)	LP 400	16 12
Caedmon	630	11	London	750	10	Vanguard	LP	16
Capitol	400	12	Lyrichord (new)	LP 400 630	16 16 16	Vitaphone	300	0
Canyon	400	12	Mercury	400	12	Westminster	500 400	16 12
Cetra-Soria	400 500	12 16	Montilla	500	12			

Table 3. Equalization Settings

(Historical Recordings Manufactured Between 1925 and 1953)

78 RPM Labels	Turnover Freq. (Hz)	Rolloff at 10 kHz (dB)	78 RPM Labels	Turnover Freq. (Hz)	Rolloff at 10 kHz (dB)	78 RPM Labels	Turnover Freq. (Hz)	Rolloff at 10 kHz (dB)
Banner Perfect	Inconclusive		Odeon (early) (pre 1947)	300 300	0 8.5	Vitaphone (motion picture)	300 950	0 18.5
Blue Bird	800	10	Mercury	400	12			
Brunswick (rare) (early) (1946-)	1000 500 300	8.5 0 16	MGM	500	12	Transcriptions		
Cameo Pathe	Inconclusive		Montilla	500	12	BBC	300	0 or 5
Capitol	400	12	Musicraft	700	14	Orthacoustic	500	16
Columbia (1926-) (1938-) (European)	250 300 300	5 16 5	Oriole Romeo	Incon		RCA Program	700 500	0 0
Coral	400 750	12 16	OKEH	300	8.5	Pre WWII	500	0
Decca (early) (1934-) (ffrr)	150 400 250	0 12 5	Parlophone (pre 1947)	300 500	0 8.5	Vertical New	300	16
Deutsche Grammophon	300	5	Polydor	300	8.5	Vertical Old	300	5
Disc	300	16	Radiofunken	400	0			
Diva	300	16	RCA Victor	See Victor				
Edison	0	0	Schirmer	1000	24			
Electrola	800	10	Supraphone	400	0			
Good Times Jazz	400	12	Telefunken	400	0			
Gramophone	300	10	Transcriptions Vertical	500 300	16 14 **			
Harmony	300	16	Ultraphon	400	0			
Hit of the Week	500	5	Vanguard	500	16			
HMV (1925-) (1946) (1946-)	250 400 800	0 10 16	Victor (1925-) (1938-) (1947-52)	300 500 500 500	0 0 8.5 12			
King	500	16	Vocalion	300	0			
Linguaphone	300	0	Vox	500	16			
London ffrr	250	5	Westminster	750	16			
Majestic	500	16	Velvet Tone	300	16			

** Vertical transcriptions have a 12 dB/ octave rolloff. Use the 14dB setting and apply the following corrections using a third octave equalizer: 5 kHz (+2 dB), 6.2 kHz (+1 dB), 8 kHz (-1 dB), 10 kHz (-4 dB), 12.5 kHz (-6 dB), 16 kHz (-8 dB), and 20 kHz (-12 dB.) Reference:

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