

**PACKBURN<sup>®</sup>** *electronics inc.*

**AUDIO NOISE SUPPRESSOR**

**MODEL 325 OWNER'S MANUAL**



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REV 16-1



## AUDIO NOISE SUPPRESSOR MODEL 325



**A single-ended noise suppressor 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 cylinder, disk, film wire and tape recordings, both monophonic and stereophonic**

**Model 325 contains three processors** designed to suppress transient noises (ticks, pops, clicks, crackle, scratch) encountered in some 100 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, more recently, digital audio.

Model 325 also incorporates a number of necessities and conveniences for the optimum playback of disk and cylinder recordings for best quality of sound.

### The Switcher:

The first noise reduction processor in the Audio Noise Suppressor is the Switcher. This is designed specifically for the reduction of noises from monophonic disk and cylinder recordings, taking advantage of the redundancy that exists in these media: the same signal is engraved on each of the two side walls of the groove. However, the distribution of particulate matter in the record material (one cause of noise) is random. Also, dirt, mildew and scratches do not affect each side wall identically.

Prior to the development of the Packburn Switcher, a monophonic disk or cylinder, if played back with a stereophonic reproducing system, was best played by summing (in the appropriate polarity) the signals from the left and right channels. The Switcher does this when in the rest position. However, at any moment when the reproduction from the left or right channel is quieter (more noise-free) than the sum signal, the Switcher can elect to reproduce just the quieter groove wall. The Switcher switches among these three possibilities (left, right, or sum) at a very rapid rate with astonishing results. At lower frequencies (from 300 Hz down) where switching would not accomplish anything, the two channels are mixed to minimize rumble.

The idea of using the Switcher on 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. The Switcher is not as effective for

vertical recordings but it has a part to play.

The switching process is *generally* not applicable for noise reduction of stereophonic records or of monophonic tape recordings or broadcast. For these, transient noise suppression must be achieved by the Blanker alone.

### The Blanker:

The second noise reduction processor is the Blanker. This is designed to cope with transient noises from any source: whether from the output of the Switcher, where noises remain that were common to both side walls of the groove, or from a stereophonic disk recording. Also, it is applicable to a monophonic tape, a broadcast or a CD record of a disk recording that has transient noises. Note that the Packburn Blanker works from any program source, in contrast to some devices that require the vertical component of a stereophonic disk to trigger their action.

The Blanker clips the amplitude of each individual positive-going or negative-going pulsation of the noise transient whenever it exceeds a threshold value determined by the peak program level in the vicinity of the transient.

The Switcher plus the Blanker comprise the Transient Noise Suppressor of the Audio Noise Suppressor.

### The Continuous Noise Suppressor:

The third noise reduction processor reduces audible hiss or white noise, whatever one prefers to call it. It is a constant annoyance in just about every cylinder, disk, wire, analog tape 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 our third processor the Continuous Noise Suppressor. This processor comes third 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 Continuous Noise Suppressor 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 of the input:** The two input channels are metered to assure that the proper signal levels are provided to the Audio Noise Suppressor. Metering takes place after the input level control and before the channel balance control.

**Channel balance control and audition of difference signal:** the balance control is needed for balancing of signals into the Switcher when playing monophonic disk or cylinder recordings. In reproducing vertical-cut recordings, the balance control also serves as a canting control. Audition of the difference signal as well as of the sum signal allows one to set the channel balance or canting adjustment with accuracy.

**Test Switch:** This switch enables selection of either the quieter or noisier groove wall by the Switcher. It is useful for demonstration and diagnostic purposes. Also, in the case of a full-width monophonic tape recording in which the oxide is flaking off, one can play it with a two-track head and use the Switcher to choose the momentarily louder channel and thus avoid dropouts.



**FACILITIES ADDITIONAL TO AND SUPPORTIVE OF THE NOISE REDUCTION PROCESSORS**

A number of necessities and conveniences are included in the Audio Noise Suppressor to assist the user in achieving optimum performance with disk and cylinder playback as well as other signal sources, as follows:

**Playback from either channel:** There is the ability to play from either channel separately of a monophonic disk or cylinder with the lower frequencies of the two channels mixed so as to eliminate rumble. This is a necessity in reproducing those occasional recordings in which one side wall is consistently noisier than the other. Such a condition can indicate that the optimum stylus is not being used, but some recordings persist in this behavior with any stylus that one may try. For these recordings it is preferable to play from just the quieter side wall of the groove and use just the Blanker for transient noise suppression.

**Transient Noise Suppressor can be switched out:** The Switcher plus the Blanker, which constitute the Transient Noise Suppressor, can both be switched out by means of a single toggle switch whenever one wishes to process a recording only through the Continuous Noise Suppressor

**Eight position bass equalization switch:** This allows selection of the commonly used bass equalization curves for 78s manufactured prior to the recording industry's standardization on the RIAA curve in 1953. Also includes the RIAA curve.

**Six position treble equalization switch:** This allows selection of the commonly used treble equalization curves for 78s as well as for those long playing records that were manufactured prior to the recording industry's standardization on the RIAA curve in 1953. Also includes the RIAA curve.

**Cutoff frequency meter:** This meter displays the ever-fluctuating value of the cutoff frequency when the Continuous Noise Suppressor is operating.

**Bypassing the Audio Noise Suppressor:** The Audio Noise Suppressor is provided with a bypass relay. This connects the output terminals to the input terminals when the power is OFF or when the ANS switch is in the "0" position. Thus, the Audio Noise Suppressor is easily removed from the circuit when it is not needed.

**SOME USERS OF THE PACKBURN AUDIO NOISE**

## SUPPRESSOR

*Customers are telling us -*

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

**“Good hiss, pop and click elimination!”**

**“Improved musical clarity!”**

**“The controls are easy to operate!”**

**“Preserves the original sound – serves archival purposes well”**

***And for those who have returned their Packburn machines for upgrading to the model 325 performance level \* -***

**“The blanker and continuous noise suppressor are more effective even on LP records.”**

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

**\* Consult factory for details**

## APPLICATION NOTES

**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 Switcher reduces the crackle. Next you can turn on the Blanker and hear the major role that it plays in eliminating or reducing noise from scratches and cracks. Then you can adjust the Continuous Noise Suppressor for the final improvement. You can even operate the TEST switch and hear the effect of choosing the noisier groove wall.

**45s and long play disks.** You can instantly hear how the Switcher reduces the crackle. Next you can turn on the Blanker and hear the major role that it plays in eliminating or reducing noise from scratches and cracks. Then you can adjust the Continuous Noise Suppressor for the final improvement. You can even operate the TEST switch and hear the effect of choosing the noisier groove wall.

**Long Play and Stereo Disks:** The improvement of these requires more 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 Blanker 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 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 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. Both the

Switcher and Blanker have a major effect in reducing transient noises from broadcast transcriptions. With acoustical disks and cylinders the Blanker plays the major role in reducing the transient noises. The Switcher can be turned up slightly for some assistance in the noise reduction. 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 equalization and 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 tapes. 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 on the part of the CD producer or the consumer. If the producer chooses to ignore what the Audio Noise Suppressor can do to improve his product, the consumer can do it on his or her own!

**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 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 Blanker circuit 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.

Carefully made stereo tape transfers of a monophonic disk or cylinder—especially a digital tape—can provide good results, as the Switcher can be employed and there should be no appreciable degradation of the noise transients that would reduce the effectiveness of the Blanker.

**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 325 Technical Specifications

## Designed for professional installations and for quality home sound systems

Outfitted to interface with 600 ohm balanced line systems or with the more customary single-ended Hi Fi systems; Provided with XLR professional connectors as well as with RCA-type phono connectors for all signal input and output terminations.

**Power Line Voltages:** U.S./ Canadian 105 volts 120 volts, 50/60 Hz  
International: 210 volts-240 volts, 50/60 Hz (consult factory)

**Power Consumption:** 20 Watts

**Size:** Width: 19" (483 mm) for rack mount, 17" (432 mm) with mounting ears removed  
Depth: 13" (332 mm), Height: 3.5" (89 mm).

**Inputs and Outputs:** There are two separate electronically balanced input channels. Separation throughout the audio frequency range is maintained in processing stereo signals, in which each signal path is provided with a Blanker, a Treble Equalization network and a Continuous Noise Suppressor and then routed through a dual OUTPUT LEVEL control to the separate output terminations.

In processing lateral-cut or vertical-cut recordings, the signals applied to the two input channels are routed through a balancing circuit to the Switcher. Or, at the operator's choice, with lateral-cut records, the signal of either channel may be individually selected for processing. To reduce the audibility of low frequency disturbances, the bass portion of the two input channels, is mixed in the proper polarity. The output of the Switcher is connected to both of the Blanker + Equalizer + Continuous Noise Suppressor channels, and the fully processed signal may be taken from either or both of the output channels.

Electronically balanced input. Single-ended input impedance is 100k ohms.  
Electronically balanced output. Single-ended output impedance is less than 1 ohm.

**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 — 6 VU or less from a 600 ohms line or by 0.4 v. or less from a single-ended source. Range of control of INPUT LEVEL potentiometer is 20 db.  
With OUTPUT LEVEL control all the way up, there is unity gain from the metering circuit to the output terminations.

**Frequency Response:** Bass response is within  $\pm 1/2$  db to 10 Hz.  
Treble response is determined by the setting of the Treble Equalization switch and the action of the Continuous Noise Suppressor.

**Treble Equalization:** is provided by the Audio Noise Suppressor by means of a six-position selector switch which enables you to match the treble portion of published equalization curves of records, old and new. Includes FLAT, FFRR, AES, RIM, LP.

**Continuous Noise Suppressor Action:** The Continuous Noise Suppressor is a low pass filter. Cutoff frequency varies from 2.5 kHz to 18 kHz in accordance with the dynamics of the program material and the nature of the surface noise. Alternatively, a fixed cutoff frequency may be selected. Meter on front panel reads the cutoff frequency. Filter has a slope approaching 12 db per octave.

**IM Distortion:** 60 Hz and 7 kHz, 4:1 at + 4 vu (1.23v.) input: 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 advantage of the Switching process, you must have equipment to play back discs or cylinders stereophonically. The two channels of reproduction must be closely matched in frequency response.

**Demonstration CD:** Available on request

**PACKBURN<sup>®</sup> electronics inc. P.O. Box 226 Syracuse, NY 13215 U.S.A.**

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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

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## Foreword

Packburn Electronics, Inc. has been in business for over 25 years, inspired by the late Richard C. Burns. What got the company running was Dick's passion for historical sound recordings and 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 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 325 Audio Noise Suppressor.

We appreciate your purchase of our product, and we want this unit to work for you as well as it has for us in the time that we have spent with it. The unit has gone through extensive testing, a one week run-in, and a listening session with test records.

The instruction manual describes how to use the Audio Noise Suppressor with a wide variety of historical sound recordings. 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 Audio Noise Suppressor consists of three noise reduction stages called the 'Switcher', the 'Blanker', and the 'Continuous Noise Suppressor' (or CNS.) As you gain experience and confidence in its operation, you will learn that the Audio Noise Suppressor is perpetually on guard, acting to suppress noises as they occur. Those who already have a reasonably well-adjusted audio system usually get the unit quickly connected and working and proceed to "enjoy".

Wishing you pleasurable listening,

Thomas N. Packard

President



## Installation of the Audio Noise Suppressor

### A. The Turntable

A stereo cartridge needs to be used even for monophonic phonograph records. If a monophonic record is played back using a monophonic cartridge, the first noise reduction stage (Switcher) won't operate to remove noise. For those using the PACKBURN for playback of 78 RPM records, stylus suggestions are provided on p. 17.

### B. The Pre-amplifier (for providing turntable signal to the PACKBURN)

The preamplifier needs to be a stereo. For optimal playback of cylinders and records of all speeds the pre-amp should have a flat high end frequency response and preferably a flat low end frequency response as opposed to RIAA rolloff and turnover equalization.<sup>1</sup> If the preamplifier has treble and bass controls they should be set flat and if it has a balance control, to the center of adjustment. The Packburn's own rolloff and turn-over equalization controls subsume those of the pre-amp.

The preference is to play all phonograph records using a pre-amplifier set as described however some only have factory-fixed RIAA roll-off equalization. Here are suggestions about what to do:

- (a) We may be able to offer suggestions for a replacement pre-amp.
- (b) The PACKBURN Audio Noise Suppressor has an inverse RIAA curve feature that can be factory enabled to counteract the pre-amplifier equalization.
- (c) Install a stereo equalizer between the preamplifier and the Audio Noise Suppressor to counteract the rolloff curve of the preamplifier. For information on how to adjust the equalizer, refer to *Stereo Equalizer Ahead of the Audio Noise Suppressor* on p. 25.

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<sup>1</sup> For 33 speed records, noise becomes easier for the Packburn to detect without high frequency rolloff. Also, some early 33 speed records do not follow the RIAA curve (refer to p. 32 of the owner's manual.)

- (d) A flat high end frequency response can be approximated by your pre-amp if it has a treble control. Listen to a 33 speed record with the Packburn's ROLLOFF control at 0 dB and notice the loss of high frequencies when turning it to 14 dB. Boost your preamplifier's treble control to restore the original sound. The treble control is then left at that setting for all records. This is only recommended for non-exacting work.
- (e) Install a pair of passive equalizers between the preamplifier and the Audio Noise Suppressor. For an example of a design, refer to *Installation of a Passive Equalization Network Ahead of the Audio Noise Suppressor* on p. 25.

C. Equipment Following the PACKBURN Audio Noise Suppressor:

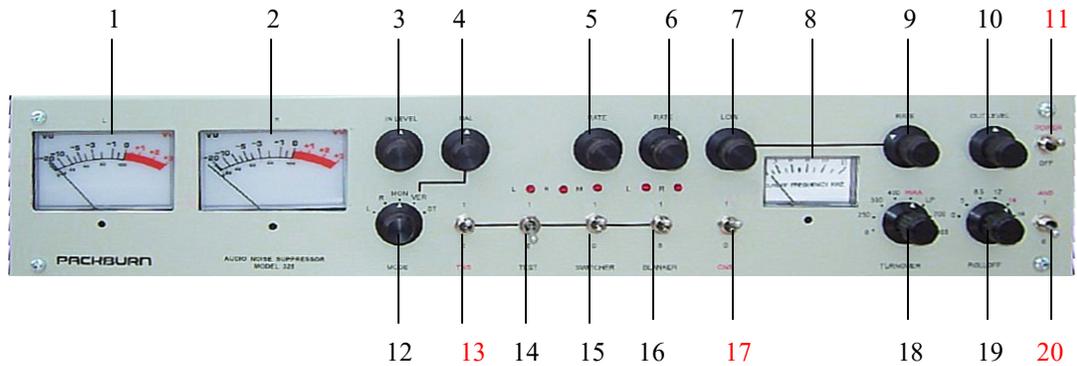
Signal processing devices such as equalizers, filters and sonic enhancers may be connected to the output of the Audio Noise Suppressor to further improve the signal that is being reproduced.

D. Input and Output Connections to the PACKBURN Audio Noise Suppressor:

The Audio Noise Suppressor accommodates typical high fidelity systems and professional audio installations. The stereo pre-amp output or other stereo signal processing device connects to the input of the PACKBURN. The PACKBURN installs in the audio system much as one would install a stereo equalizer.

The RCA connectors are used for a typical high fidelity system. For professional audio systems, the three prong connectors are used. Pin 1 of the three prong connector is grounded and for single-ended (unbalanced line) systems, signal may be provided on either pin 2 or pin 3. For 600 Ohm balanced line systems, signal is provided on both pins 2 and 3. When utilizing the RCA connectors, it is prudent to insert the grounding adapters provided by PACKBURN into the three prong input connectors. The adapters ground the unused pin 2 inputs.

## Front Panel Controls



1 <b>L</b> - left input level	11 <b>Power</b> - Packburn on/off
2 <b>R</b> - right input level	12 <b>Mode</b> - selects how input signals to be processed
3 <b>Input Level</b> - adjusts meter readings	13 <b>TNS</b> – transient noise suppressor (switcher and blanker) on/off
4 <b>Bal</b> - balances inputs if Mode in Mon or Ver	14 <b>Test</b> - normally leave in “0” see instructions
5 <b>Rate</b> - Switcher sensitivity	15 <b>Switcher</b> - on/off
6 <b>Rate</b> - Blanker sensitivity	16 <b>Blanker</b> - on/off
7 <b>Low</b> - CNS minimum cutoff frequency	17 <b>CNS</b> - continuous noise suppressor on/off
8 <b>CNS cutoff frequency</b>	18 <b>Turnover</b> - low frequency equalization
9 <b>Rate</b> - CNS sensitivity	19 <b>Roll-off</b> - high frequency equalization
10 <b>Output Level</b> - adjusts output terminal levels	20 <b>ANS</b> - audio noise suppressor (TNS and CNS) in or out of system

### A. Enablement Controls (INPUT/ OUTPUT LEVELS, POWER, ANS, TNS, CNS)

INPUT LEVEL is set for proper readings on the L (left input) and R (right input) VU meters. Music or speech should have peak readings at about or slightly above 0 VU. If an occasional tick causes the meter needle to go off scale or the meter readings to mismatch, do not worry about it if the program levels are correct. The input level control boosts the input signals up to +20 dB.

OUTPUT LEVEL sets an output level that is convenient for the user, the input level already having been set for proper VU meter readings. The PACKBURN provides unity gain (input and output terminal signal levels match each other) when the two controls are at 12:00 and also for other settings.

POWER provides line voltage to the PACKBURN. When in the off position, the left input is directly fed to the left output and also the right input is directly fed to the right output. This means that even when the PACKBURN is not powered, your audio system will have signal continuity.

ANS (audio noise suppressor) sets the PACKBURN in or out of your audio system. When switched out ('0') the left input is directly fed to the left output and also the right input is directly fed to the right output. When switched to '1' the left and right inputs are fed to the outputs through the PACKBURN.

This switch allows the user to perform a full "A - B" comparison test on the PACKBURN. However, in order for this test to be valid, the signal levels at the input and output terminals of the PACKBURN must match one another and the PACKBURN equalization curves must be flat (turnover control set to RIAA, and rolloff set to 0 Hz.) Further, for a comparison involving the mode switch in "mon", the amplifier following the PACKBURN should be switched to monaural. All of this makes for a "complete in-out" comparison of the device. There is a less complete but much easier alternative: An "A - B" comparison is performed on just the noise reduction stages of the PACKBURN by simply turning the TNS and CNS switches on or off, no other adjustments being needed.

TNS (transient noise suppressor) turns the Switcher and Blanker noise reduction stages on or off, overriding the individual Switcher and Blanker on-off switches. These noise reduction stages reduce ticks and clicks and may reduce hiss if made up of a succession of small clicks, all of this referred to as transient noise.

CNS (continuous noise suppressor) turns the CNS noise reduction stage on or off. This stage reduces hiss.

## B. MODE Switch

This switch determines how the PACKBURN is to process the input signal. In the ST (stereo) position, the PACKBURN treats the input as having two different musical signals and so feeds stereo to the L and R outputs. When the switch is set to all of its other positions L (left), R (right), MON (monaural) or VER (vertical), the PACKBURN treats the two musical input signals as having little and usually no stereo content and so converts the input signals into a matched, monaural signal at the left and right outputs. The signal on each of the two output channels is predominantly the following:

L	Left input signal,
R	Right input signal,
MON	Mix of Left and Right input signals,
VER	Mix of Left and Right input signals phased for vertical-cut (Edison) cylinders and discs,
ST	Left input signal provided to left output, Right input signal provided to right output.

The “MON” position is normally used for monaural tape, film, 78, 45 or 33-1/2 RPM records or signal sources.

The “VER” position is used for monaural 78 RPM *vertical cut* records such as Edison cylinders or diamond discs.

The “L” or “R” positions are normally used for purposes of adjusting the BAL (balance) control or selecting the correct stylus size for the most exacting work, as will be described below. However, you may find occasions when the L or R positions provide best noise reduction, so feel free to use them.

The “ST” position is used for CDs, tape, film, 33-1/3 or 45 RPM records, or other signal sources having noticeable stereo imagery.

## C. Switcher Controls (BAL, RATE, TEST, SWITCHER-on/off)

The Switcher is the first noise reduction stage. The Switcher reduces pops and clicks and may reduce hiss if made up of a succession of small clicks, all of this being referred to as transient noise. This stage is active only in the “MON” and “VER” positions of the mode switch.

TEST is normally kept in the off ('0') position. This switch provides a way to check the effectiveness of the Switcher. In the off position the quietest input signal is always selected by the Switcher for playback, whereas in the '1' position the noisiest signal is always selected! The comparison should be made with the Blanker and CNS stages turned off. The TEST switch has some playback utility as well. Some customers have used it for monaurally recorded reel-to-reel tape or film reproduced stereophonically. The "noisiest" input is always selected, in this case the input not having a brief drop-out! Transient noise or continuous noise on the tape or film is taken care of by the other noise reduction stages.

BAL (balance) matches the levels of the left and right input signals, something that is important for optimum use of the Switcher. BAL. can be set by comparing the mode L and mode R signals and adjusting until the two signals are equal. Alternatively, turn the BLANKER and CNS off and MODE to "VER". Set BAL. to the music null (cancellation of the music). If the transient noise is canceling, the switcher won't operate properly (see p. 15.) Also, if there isn't a null, make sure the treble and bass control settings in the pre-amp ahead of the PACKBURN are the same. BAL. corrects up to a 6 dB mismatch between the input signal levels.

(SWITCHER) RATE increases the sensitivity of the Switcher when it is adjusted clockwise. As the sensitivity increases, the L, R, and M (mixed L and R) lights increasingly flicker, indicating that the L and R input signals are being selected with increasing frequency over the mixed monaural signal as the quietest signal for playback. If the L and R lights don't flicker to the same extent, make sure the input signals have been properly balanced. If the balance is correct, the lights are just indicating that there is more noise in one input signal than the other. The control is often operated at 5:00 (full clockwise rotation).

#### D. Blanker Controls (RATE, BLANKER-on/off)

The Blanker is the second noise reduction stage. The Blanker is a complimentary strategy for reducing transient noise. The Switcher and Blanker form collectively the TNS (transient noise suppressor).

(BLANKER) RATE increases the sensitivity of the Blanker 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.

E. Continuous Noise Suppressor Controls (LOW, RATE, CNS-on/off)

The CNS (continuous noise suppressor) is the third noise reduction stage. The CNS reduces hiss, referred to as Continuous Noise.

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), LOW 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 LOW 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 RATE may require LOW to be increased from its initial setting. Typical RATE control settings are 10:00 and 12:00.

F. Equalization Controls (TURNOVER, ROLLOFF):

TURNOVER provides the most common eight low frequency (bass) equalization curves for playback of 78, 45 and 33-1/3 RPM phonograph records, and also for cylinders. Refer to *Equalization Settings*, pp. 31-35. For CDs, magnetic tape, video, film, broadcast or other media, set 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 33-1/3 RPM phonograph records, and also cylinders. Refer to *Equalization Settings*, pp. 31-35. For CDs, magnetic tape, video, film, broadcast or other media, set rolloff to "0". If you change the ROLLOFF setting, it might be necessary to change the CNS control settings.

## Getting Started

1. Install the Packburn between your pre-amp and the stage of your audio system to which the pre-amp was connected. Don't connect the PACKBURN to the line voltage just yet.
2. Preset these controls as shown :

POWER	Off	Start with the power switch off.
INPUT LEVEL	12:00	
BAL.	12:00	
OUTPUT LEVEL	12:00	
MODE	ST	For stereo music (CDs, tape, film, 45's, 33-1/3 speed)
	MON	For monaural music (78's, 45's, 33-1/3 speed discs, film)
	VER	For vertical-cut (Edison) cylinders or discs
TURNOVER	>>	Set the bass equalization. See pp. 32, 34-35.
ROLLOFF	>>	Set the treble equalization. See pp. 32, 34-35.
TNS	0	
TEST	0	
SWITCHER	0	
BLANKER	0	
CNS	0	
ANS	1	
	>>	Start playing music. You should hear sound through your audio system which is now bypassing the PACKBURN. If you don't hear anything, check your patch cables.

3. Connect the PACKBURN to 120 VAC (unless factory-set for 230 VAC).

POWER	On	At least one light should light. Also, you should still hear music, otherwise, make sure that the output cable has not been plugged by mistake into the input terminals.
-------	----	--

4. Adjust the level controls:

INPUT LEVEL	>>	Adjust the preamp ahead of the PACKBURN or INPUT LEVEL until the left and right meters are reading 0 VU on the program (music).
OUTPUT LEVEL	>>	Adjust OUTPUT LEVEL for level match when the ANS is switched between '0' and '1', or to your liking.

5. Turn on just the SWITCHER (noise reduction stage 1)

MODE	MON or VER	The switcher applies only to the MON and VER modes. Stereo records not having much stereo imagery to sacrifice may be played in MON. Stereo recordings are normally played in the ST mode. When the ST mode is selected, the SWITCHER stage is automatically bypassed.
TNS	1	
TEST	0	
SWITCHER	1 ←	
BLANKER	0	
CNS	0	
ANS	1	
BAL.	> >	Select VER mode. Adjust BAL. for a null. Just the music should null, not the noise, see p. 15. Alternatively, adjust BAL. for equal music levels between mode R and mode L.
(switcher) RATE	> >	Adjust clockwise for best noise reduction without musical disturbance. It is often set fully clockwise. L, R and M lights should be flickering.

6. Turn on just the BLANKER (noise reduction stage 2)

MODE	L R MON VER ST	Select as desired.
TNS	1	
TEST	0	
SWITCHER	0	
BLANKER	1 ←	
CNS	0	
ANS	1	
(blanker) RATE	> >	Adjust clockwise for best noise reduction without musical disturbance. A 3:00 setting is typical for records in fair condition. L and R blanker lights should be flickering.

7. Turn on just the CNS (noise reduction stage 3):

MODE	L R MON VER ST	Select as desired.
TNS	0	TNS overrides the Switcher and Blanker switches.
CNS ANS	1 ← 1	
(cns) RATE		Start at the 8:00 (full counter-clockwise) position.
LOW	> >	Select a quiet passage of music. Adjust LOW as you would an ordinary treble control to remove hiss. Ignore for the moment any dulling of the music.
(cns) RATE	> >	Select a loud passage of music. Adjust (CNS) RATE so the music is not dulled. In newer recordings, the frequency meter should read about 10 kHz to 15 kHz during the most brilliant passages of music.

8. Turn on the noise reduction controls in combination (the Switcher, Blanker and CNS stages are all turned on in the following example):

MODE	MON or VER	
TNS	1	
TEST	0	
SWITCHER	1 ←	Adjust switcher, blanker and CNS rates in combination for the optimum result.
BLANKER	1 ←	
CNS	1 ←	
ANS	1	

9. Turn on the noise reduction controls in combination for a Stereo recording (the Blanker and CNS stages are turned on):

MODE	ST	When MODE is in ST, the Switcher is automatically bypassed.
TNS	1	
BLANKER	1 ←	Adjust blanker and CNS rates in combination for the optimum result.
CNS	1 ←	
ANS	1	

## Technical Principles of Operation

### A. Mode Switch

In all settings of the MODE switch except the ST (stereo) setting, the lower frequencies of the left and right input signals to the PACKBURN are mixed below 300 Hz turnover at a 6 dB/octave slope. This pretty much eliminates the rumble component. In the L, R and MON settings, the low frequency mix is phased for lateral-cut records, not vertical-cut records. The mix is phased for vertical-cut records only in the VER setting.

MODE lets you audition the “difference component”, that is, the difference between the two input signals. For monophonic records played back stereophonically the two signals are ideally the same so the signal after one is subtracted from the other is ideally “zero”. Thus for monophonic records the difference component helps you obtain optimum channel balance. The difference component is obtained by playing lateral-cut records in VER and vertical-cut records in MON.

The Switcher operation is activated only in MON and VER. In the L, R and ST settings, the Switcher stage is bypassed and the signal is applied to the Blanker and CNS stages, a pair of them in each channel.

For single channel non-disc recordings, use the ST setting.

### B. Switcher

The Switcher process relies on L and R input signals having identical program material but different transient noise. This is what occurs when monophonic records (lateral or vertical-cut) are played stereophonically. For lateral-cut records, the two input signals are derived from the two sidewalls of the record groove, the sidewalls having identical program material. By setting BAL for equal input levels, the two signals differ only by the transient noise, since transient imperfections in the recording medium seldom disrupt both sidewalls at the same time. (Switcher) RATE adjusts the threshold sensitivity of the Switcher. The TEST switch determines whether the Switcher selects the noisier sidewall or the quieter groove wall for playback. The operation of the Switcher is visible in the blinking of the three LEDs, depending on whether the Switcher has chosen L, R or M (center mix) for playback.

### C. Blanker

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. Thus, a device that will limit noise impulses so that the amplitude does not appreciably exceed the level of the music (or other program material) at the moment of occurrence of the noise will reduce these noises to inaudibility or to a sufficiently low value so that they no longer constitute an annoyance.

The Blankers clip noise impulses as soon as they exceed the amplitude of the wave envelope of the program material. At each of those points in time the instantaneous level is held until the amplitude of the noise impulse comes back to the program level. Thus, a separate clipping action occurs for each positive or negative noise pulse. The Blankers are 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 (blanker) RATE control establishes the sensitivity threshold.

### D. 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 15 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 rolloff approaches 12 decibels per octave.

The cutoff frequency, rather than being responsive to the signal level only, is determined 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. The CNS is able to detect the difference between a noise transient to be dulled and a musical transient. As a result, the cutoff frequency as displayed by the frequency meter normally remains unchanged due to a noise transient but rises rapidly upon the occurrence of a musical transient.

## **Suggestions for Optimum Processing of Historic Recordings**

### **A. Cleaning**

Optimum 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 rule. If the record appears to have deteriorated, consider creating a safety copy before proceeding. 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**

It has been our experience that most low-frequency thumps in the reproduction of 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 Audio Noise Suppressor will not remove thumps but will frequently reduce swish.

### **C. Choice of Optimum Stylus**

An audible indication that the stylus size is not optimum is an unequal distortion in the left or right input signals revealed by comparing MODE “L” and “R”. Other indications are a distortion even when MODE is in “MON” or excessive rumble. The stylus should be chosen that gives the minimum noise and clearest sound with the Transient Noise Suppressor in operation.

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 optimum 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.)

It is also advisable to audition the two sidewalls of the groove to determine that they sound alike. If one side wall sounds hissier than the other, try changing styli. It has been our experience that the hiss of the two channels will match each other, in most cases, by proper choice of stylus.

We have encountered cases especially with lacquer discs (sometimes erroneously referred to as acetates) where one sidewall of the groove reproduces with more hiss than the other sidewall, regardless of stylus choice. Sometimes the hiss even shifts from one sidewall to the other. In such cases, it is especially advisable to experiment with the Switching rate.

If one sidewall is consistently hissier than the other, you may find it preferable to set the MODE switch to L or R to select the quieter channel and using just the Blanker and CNS stages.

#### D. TEST Switch

This switch is useful in diagnosing what the Switcher is accomplishing. When TEST is set to "1" position, the switching action of the Switcher is reversed such that the noisiest instantaneous signal from among the L, R or M input signals is played back (M is the monaural mix of L and R.)

#### E. The Vertical Component

In monophonic lateral-cut recordings, the vertical component of stylus motion is caused by noise components, such as surface noises of all kinds, turntable rumble, record warpage, off-

center playback, surface unevenness and by signal components introduced by tracking error and tracing error including "pinch effect". Listening to the vertical component can be a valuable diagnostic procedure: Turn the MODE switch to VER, rotate (Switcher) RATE fully counter-clockwise, and switch the Blankers OFF. If your playback equipment is in proper alignment and you are using the Transient Noise Suppressor according to instructions, the vertical component of any reasonably noisy record should consist almost entirely of noise.

By adjusting BAL, you should be able to find a position where the program signal nulls. In fact, that is where the control should normally be set. Once the two signals are in balance, the vertical component can be auditioned for difficulties such as record wear.

## Vertical-Cut Records

### A. Switcher

Vertical-cut records such as Pathe and other hill and dale discs, Edison cylinders, and Edison Diamond Discs differ 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 Switcher to choose from. However, those who work extensively with vertical recordings tell us that the Switcher in the newest PACKBURN Model 325 is more able to remove noise with that type of groove. The Switcher RATE may need to be set below 12:00 if the lateral component is strong in comparison to the music level. The lateral component is audited by setting the mode switch to MON.

### B. BAL (balance)

BAL should be carefully adjusted for the best cancellation of the lateral component. This process is referred to as “canting”. Comparing the MON and VER positions of the MODE switch can help you determine the best setting for the BAL control. The optimum setting can be different from record to record.

Vertical-cut recordings are intended to be played only in the VER setting of the mode switch. The L and R settings normally are not appropriate because for vertical-cut records the low frequency components (frequencies below 300 Hz) are improperly mixed.

### C. With and without (A/B) Comparison

Turn the TNS and CNS switches on and off together. Using the ANS switch for A/B comparison is possible but involves effort: Either the left or right signal fed to the Packburn will need to be inverted, the PACKBURN MODE switch operated in MON instead of VER, and the signal from the PACKBURN monaurally mixed. The ANS switch will then provide A/B comparison also.

## Recommendations for Preserving Perishable Media

### A. 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 settings L, R, MON and VER 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 a switcher stage either in the PACKBURN or a future analog or computerized system that comes along.

### B. Reel-to-Reel Tape

If the perishable medium is monophonic reel-to-reel tape, azimuth alignment of the tape head is critical. To make the alignment use either a phase monitor oscilloscope (see below) or audition the difference component (MODE switch in VER.)

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. Generally the Transient Noise Suppressor is the most effective when processing first generation media.

### C. 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 Switcher stage will be able to function.

### 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.

## **Compact Discs - Tape - Broadcasts**

### A. 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 Audio Noise Suppressor has a role to play. Re-equalization of the signal before the Audio Noise Suppressor might be required. Copyists sometimes transferred 78s using the RIAA playback curve if that was the only equipment that was available. When playing CD records that do not require noise reduction, the Audio Noise Suppressor can be bypassed by turning the POWER switch off.

### B. Magnetic Tape and Broadcasts

Broadcasts, both live and on tape, and magnetic tape recordings in general can be processed very successfully using the Audio Noise Suppressor. Stereo tapes and broadcasts can be processed with the MODE switch set to ST (stereo). The Blanker removes transient noise if there is any to suppress, and the CNS removes white noise (hiss.) The Switcher is bypassed in the ST position.

If the tape or broadcast is a copy of a 78 rpm record, re-equalization of the signal before the Audio Noise Suppressor may be required. Copyists sometimes transferred 78s using the RIAA playback curve if that was the only equipment that was available.

Tape is susceptible to random dropout. The Switcher may address this problem for full-width monophonic tapes played back in stereo. With the MODE switch in MON and TEST in the "1" position, the Switcher will select the momentarily louder of the two channels, i.e., the channel having the least drop-out. The Blanker and CNS noise reduction stages then remove transient noise (if there is any) and continuous noise.

The tape recording may have been made with an intervening acoustic link such as the coupling of sound from a loudspeaker to a microphone. Neither the Switcher nor Blanker will be able to remove transient noise, however, the CNS will remove continuous noise.

### C. Film Recordings, Wire Recordings

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

For film whose audio track is monaural, the Switcher might have a role to play if the audio track is played back stereophonically. First, set the MODE switch to VER to audit the difference component between the two signals. After balancing the two inputs if transient noise seems the most problematic, TEST should be set to '0'. If there are random bursts in the program material due to drop-out, TEST is perhaps better set to '1'. After the (Switcher) RATE has been adjusted, the L, R and MON settings of the MODE switch should be compared, choosing for playback the setting that provides the best sound quality.

## The VU Meters

The VU Meters are, strictly speaking, peak reading meters. They are connected following the INPUT LEVEL and TURNOVER controls but preceding the balance (BAL) control. The purpose of the meters is to assure that the Audio Noise Suppressor is not overloaded. BAL has no effect on the meter readings, rather, it serves as a fine level setting whose setting is best left to the ear.

The VU meters also follow the anti-RIAA equalization circuit when this circuit has been activated at the factory (refer to Installation Instructions for more information.) The anti-RIAA (75  $\mu$ s) circuit emphasizes the high frequencies of the input signals. Since the VU meters follow the equalization circuits (a circuit provided in each channel), they are displaying the true input signal being processed.

The balance control on your pre-amplifier ahead of the Audio Noise Suppressor should be adjusted so that the VU Meters yield approximately equal readings on the program material. If one channel has louder ticks than the other, its meter can be expected to register a higher level. Your adjustment should be to the program material: music or speech, whose peak readings should be at about or slightly above 0 VU. If an occasional tick causes the meter needle to go off scale, do not worry about it if the program levels are correct.

## Optimizing Other Components in Your Audio System

### A. Pre-Amplifier Ahead of the Packburn

The frequency response of the left and right signals from the pre-amplifier ahead of the Packburn need to match if the Switcher is to operate to best advantage.

- 1 Set the treble and bass controls on your pre-amplifier "flat."
- 2 While playing a monophonic record, adjust your pre-amplifier balance and level controls, and the INPUT LEVEL control on the Packburn for good meter readings.
- 3 Set the MODE switch to VER.
- 4 Adjust BAL. for best signal cancellation.
- 5 Adjust the treble control on just one channel of your pre-amplifier to see if you can exact better signal cancellation.
- 6 Readjust BAL. if necessary.

### B. Stereo Equalizer Ahead of the Packburn

If an equalizer is inserted after the pre-amplifier and ahead of the Packburn, its two channels should be matched band by band using the above procedure or alternatively, a phase-monitoring oscilloscope (see next section.)

One purpose for the equalizer is that it can provide the desired flat treble response to the Packburn even if you have a pre-amplifier that only avails the RIAA high frequency rolloff curve. The equalizer should be set as follows:

1kHz (0 dB), 2 kHz (+2.6 dB), 3 kHz (+4.8 dB), 5 kHz (+8.2 dB), 6 kHz (+9.6 dB), 7kHz (+10.8 dB), 8 kHz (+11.9 dB), 9 kHz (+12.9 dB), 10 kHz (+13.6 dB), 11 kHz (+15.3 dB), 12 kHz (+17.1 dB) (Tremaine, *Audio Cyclopedia*, Howard W. Sams, Indianapolis, p. 668.)

This equalizer may also be used to compensate tapes or discs having frequency imbalance between the two channels, or insufficient high frequencies.

### C. Phase Monitoring Oscilloscope

The cathode ray oscilloscope is a valuable tool for accurately aligning a stereo system used to play back monophonic records or stereo tapes of monophonic records into the Audio Noise Suppressor.

Setting the Phase Monitor Oscilloscope:

1. Adjust the input signals to the Audio Noise Suppressor for approximately equal levels.
2. Connect the vertical and horizontal amplifier inputs of the oscilloscope to the L input of the Audio Noise Suppressor.
3. While playing the record, adjust the controls of the oscilloscope until the display (the vector sum is about 45 degrees from the vertical).
4. Now, connect the horizontal and vertical amplifier inputs to L and R inputs two audition the vector differences between the two input signals.

For a monaural disc or tape played with a stereo pick-up, the program component will lie on the 45 degree incline whereas transient noise is a “difference component” and so appears as vectorial bursts at other than the 45 degree incline. It is these bursts that can be suppressed by the Switcher. The Blanker can suppress star bursts in all directions.

Mistracking of a record will cause the oscilloscope to display an ellipse rather than a straight line. A relative mistracking is when the signal strengths of the two channels do not consistently match. This type of mistracking will cause the line to vary from the 45 degree angle.

A frequency response mismatch will display as an ellipse usually at certain audio frequencies. Matching the two channels of your pre-amplifier or equalizer is similar to the procedure outlined above except that the treble, bass and frequency band controls are adjusted until the oscilloscope displays the straight line. A series of tones may be used as the signal source. For each tone, the pre-amplifier or equalizer is adjusted so the signal is displayed along the 45 degree line.

Alignment of a tape recorder playback head is most accurately accomplished by pre-recording simultaneously in both channels a series of oscillator tones starting at the low frequency end of the audio spectrum.

## Trouble - Shooting Procedures

1. *There is no output signal. POWER is 1 (on), and ANS is 1 (engaged.)*

Make sure the cables are not crisscrossed, i.e., the one that feeds signal to the Packburn has been connected to the L and R input receptacles and the one that feeds signal from the Packburn has been connected to the output receptacles of the Packburn.

2. *The Switcher is not reducing noise at all. The Audio Noise Suppressor is being fed signal from a noisy monophonic record through a stereo pre-amplifier with proper equalization. The Switcher controls have been properly adjusted including the test switch.*

Set the MODE switch to VER. If there is a reduction in both the signal component and transient noise component, the incoming signals are in fact monaural. The record itself might be a 78 rpm dubbing in which the ticks are equally combined in both channels. Try a different record. If this doesn't work, check your equipment. The phonograph cartridge might be monaural. Check its terminals. The cartridge could be stereophonic but operating in monaural due to a shorting wire between two of its terminals. Follow manufacturer instructions for converting the cartridge to stereo.

3. *There is a dull output signal when MODE is MON. The L and R Switcher lights never light.*

This probably indicates that there is a bad connection, perhaps a bad cable, in the circuit ahead of the Audio Noise Suppressor and/ or an extremely out-of-balance signal level. This should be indicated by little or no signal in one of the VU meters. The dull sound is due to the low frequency components in the lone signal feeding into the Packburn being fed into the disconnected channel through the low frequency mixing circuit. The Switcher then chooses that signal for playback. Solid, non-intermittent connections are important especially for proper operation of the Switcher.

4. *There is no setting of the BALANCE control that produces a good null. The MODE switch is in VER and a monophonic record is being played. The equalization curves of the two input signals being provided to the Audio Noise Suppressor are matched.*

The Audio Noise Suppressor is provided with professional balanced XLR input sockets. If the RCA connectors are being used, it is good practice to ground the unused inputs (pin 2 of each of the XLR input sockets.)

5. *The noise worsens when the SWITCHER RATE control is turned up (clockwise rotation.)*

Make sure that the TEST switch is '0' (off.) The Switcher will then be choosing the quieter instead of the noisier of the two input signals for playback.

6. *The Switcher is distorting the sound when the signal source is a stereo tape recording made from a monophonic record.*

Check the azimuth alignment of the playback head with reference to the tape that you are playing by using the VER position of the MODE switch or a phase monitor oscilloscope. See pp. 18, 26.

7. *The Switcher and Blanker are not operating. The pre-amplifier to the Audio Noise Suppressor has the correct equalization per instructions, and the INPUT LEVEL control has been properly adjusted.*

The TNS switch could be in the '0' position, de-activating the Transient Noise Suppressor (i.e. Switcher and Blanker.)

8. *There is not much Frequency Meter action even though the CNS switch is '1' (on) and CNS RATE is fully clockwise.*

This could be an indication that the record is especially hissy, or that the high frequency levels in the signal to the Audio Noise Suppressor have been unduly exaggerated. This could happen, for example, if your pre-amplifier has a flat treble characteristic and you have had the PACKBURN factory set for RIAA cancellation. This factory setting is intended for use with a pre-amplifier having an RIAA treble rolloff characteristic.

The following test determines whether the factory setting has been activated: Set the ROLLOFF switch to 0, the CNS switch to '0', and use the ANS switch to find a brighter sound when it is in the '1' position.

9. *The sound is garbled when playing a stereo record or CD, especially during loud passages. The level readings are proper.*

Make sure the MODE switch is in ST. If the MODE switch is in MON or VER, the Switcher can chop up the music as it tries to play the instantaneously quieter of the two stereo input signals.

10. *None of the above applies.*

Before contacting us, we recommend having certain information on hand, preferably taking down a few notes while observing the problem. Here are some questions we will ask you:

- What problem is being experienced?
- What are the control and switch settings on the Audio Noise Suppressor (described in terms of clock setting)?
- Is the problem in just one output channel? If so, which channel (L or R) is it in?
- If you swap the input conductors, does the problem follow the conductor (in which case the problem is very likely to be ahead of the Audio Noise Suppressor.)
- If you try varying each of the controls, are there any that have an effect on the problem?
- What is the serial number of the machine?

## Equalization Settings

Traditionally, the inherent equalization curves used for cutting electrical recordings have been specified in terms of a “bass-turnover frequency” and “treble pre-emphasis.” It is intended that the playback equalization curve be the inverse of the equalization curve used during manufacture of the record.

The Packburn rolloff and turnover controls perform as intended only if the pre-amplifier ahead of the Packburn is properly set. See Installation Instructions, p. 5.

### A. Turnover

Bass-turnover is the attenuation of low frequencies during record manufacturing in order to limit groove modulation. Bass limiting was introduced with early 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. The playback equipment was designed to accentuate the frequencies below the turnover setting to restore the bass signal. TURNOVER settings are the frequencies in Hz where the bass is boosted 3 dB.

### B. Treble Pre-emphasis/ Rolloff

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.

The rolloff slope is 6 dB/ octave except for the 8.5 dB setting where the slope is 2.5 dB/ octave. Rolloff settings are the attenuations (in Decibels) occurring at 10 kHz.

### C. 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.

### D. Records Made After 1955

Set TURNOVER to 500 Hz and ROLLOFF to 14 dB.

In 1953 the recording industry standardized on the RIAA playback curve.

### E. Records Made Before 1925

Set TURNOVER to 0 Hz or as needed, and ROLLOFF to 0 dB or as needed.

Some maintain that acoustic discs and cylinders 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.

#### F. Records Made Between 1925 and 1955

Set the TURNOVER and ROLLOFF per the following tables.

The need for equalization curves for playback of electrical records has never been controversial but 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.

**Records Made Between 1925 and 1955**  
**TURNOVER (T) and ROLLOFF (R) Settings**

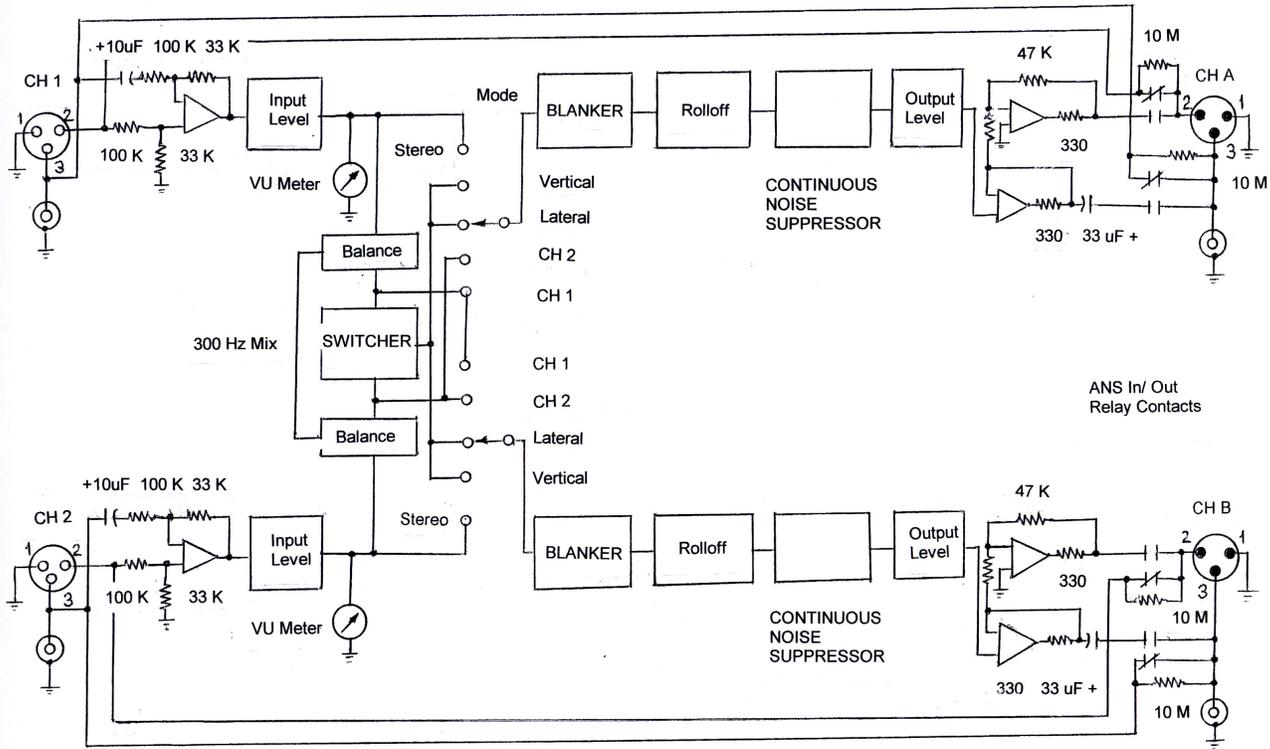
78 ↓	T	R	78 ↓	T	R	78 ↓	T	R
Banner Perfect	Inconclusive		Odeon (early) (pre 1947)	300 300	0 8.5	Vitaphone (motion picture)	300 950	0 18.5
Blue Bird	800	10	Mercury	400	12			
Brunswick (rare) (early) (1946-)	1000 500 300	8.5 0 16	MGM	500	12			
Cameo Pathe	Inconclusive		Montilla	500	12			
Capitol	400	12	Musicraft	700	14			
Columbia (1926-) (1938-) (European)	250 300 300	5 16 5	Oriole Romeo	Incon				
Coral	400 750	12 16	OKEH	300	8.5			
Decca (early) (1934-) (ffrr)	150 400 250	0 12 5	Parlophone (pre 1947)	300 500	0 8.5			
Deutsche Grammophon	300	5	Polydor	300	8.5			
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 ffr	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:

45 ↓	T	R	33 ↓	T	R	33 ↓	T	R
Columbia	500	16	Colosseum	400 LP	12 16	Oxford	750	16
Decca	750	16	Columbia	LP	16	Odeon	300	8.5
Mercury	400	12	Concert Hall	400 LP LP	12 16 8.5	Parlophone	300	8.5
MGM	500	12	Cook	500	12	Period	500	16
RCA Victor	800	10				Philharmonia	400	12
			Coral	400	12	Polydor	300	8.5
			Decca (FFRR '51) (FFRR '53)	400 LP 300 450	12 16 14 14	Polymusic	500	16
			Dial	750	16	Rachmaninoff	750	16
33 ↓			Electra	630	16	RCA 1948 1949 1953	500 500 500	10.5 12 14
Allegro	750	16	EMS	400	12	Remington	500	16
Allied	500	16	Epic	750	16	Renaissance	750	12
American Record Society	500	12	Esoteric	500 400	12 12	Stradivari	750	16
Angel	500	12	Festival	750	16	Telefunken	400	0
Arizona	400	12	Folkways	630	16	Ultraphone	400	0
Atlantic	500	16	Good Time Jazz	400	12	Urania (Most) (New)	LP 400	16 12
Audio Fidelity	500	16	Handel Society	750	16	Vanguard	LP	16
Bach Guild	750	16	Haydn Society	750	16	Vitaphone	300	0
Banner	750	16	HMV	800	10	Westminster	500 400	16 12
Bartok	630	16	London	750	10			
Boston	630	16	Lyrichord (new)	LP 400 630	16 16 16	<b>Transcriptions</b>		
Blue Note Jazz	400	12	Mercury	400	12	BBC	300	0 or 5
Caedmon	630	11	MGM	500	12	Orthacoustic	500	16
Capitol	400	12	Montilla	500	12	RCA Program	700 500	0 0
Canyon	400	12	New Records	750	16	Pre WWII	500	0
Cetra-Soria	400 500	12 16	Oceanic	LP	16	Vertical New	300	16
			Okeh	300	8.5	Vertical Old	300	5

# Input/ Output Schematic and Block Diagram

For models 323 AA, 325



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