dbx® Model 222

type II noise reduction system
for tape & disc

INSTRUCTION MANUAL



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WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

Fig. 1 — dbx Model 222 Rear Panel

Notes: To avoid repetition, the word "preamp" is used to mean receiver, preamplifier, integrated amplifier/preamplifier, or the tape monitor loop of an equalizer, reverb unit or other device. See Figures 3 through 9 for connection diagrams.

Preamp or Receiver Connections

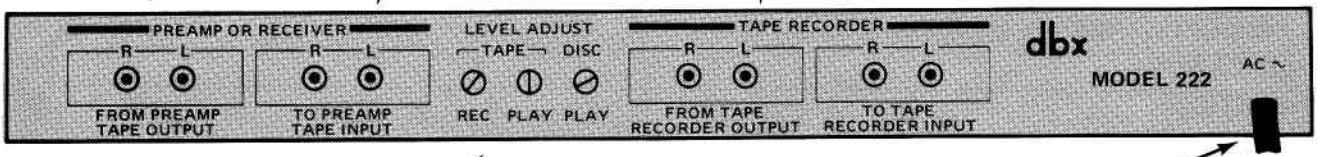
INPUTS Connect cables from your preamp's TAPE OUTPUTS (REC OUT of the Tape Monitor Loop) to these inputs.

OUTPUTS Connect cables from these outputs to your preamp's TAPE INPUTS (PLAY IN of the Tape Monitor Loop).

Tape Recorder Connections

INPUTS Connect cables from your tape recorder's LINE, PLAY or MONITOR outputs to these inputs.

OUTPUTS Connect cables from these outputs to the RECORD or LINE inputs of your tape recorder. (If you are using the 222 only for decoding dbx discs, you need not connect any cables to these jacks.)



Level Adjust

TAPE REC & PLAY/ DISC PLAY These screwdriver adjustable controls are for maintaining the same average signal level with or without 222 processing. Adjustment is not critical for proper encoding and decoding. See page 13 for details of their adjustment.

AC Mains Connection

AC POWER CABLE Connect this cable to a 117 V AC, 50 or 60 Hz AC power source only. Models for use with other power sources are available outside the continental United States. Contact the dbx factory for information.

Fig. 2 — dbx Model 222 Front Panel

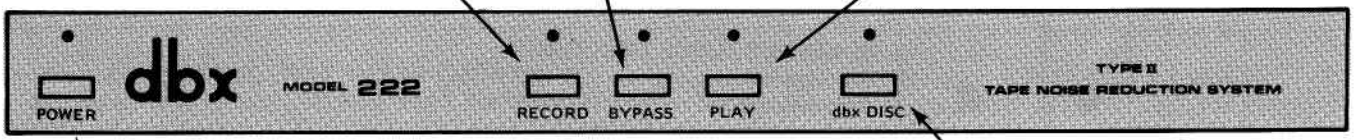
Processor Function Selectors

NOTE: RECORD, BYPASS, and PLAY are interlocking pushbuttons; only one button is to be pressed in at a given time.

RECORD Press this button when you want to make a dbx encoded tape from a normal (non-encoded) program. When set for recording, a green LED above the button is illuminated; be sure the "dbx DISC" button is not engaged (its LED should be OFF).

BYPASS Press this button when you want to make a conventional tape recording (i.e., a non dbx-encoded tape) from a non-encoded program, or when you want to play a conventional non-encoded tape. When set for bypass, a red LED above the button is illuminated.

PLAY Press this button when you want to play back a dbx encoded tape or a dbx encoded disc (or when you want to simultaneously listen to an encoded disc while making an encoded tape recording of that disc). When set for playback, a green LED above the button is illuminated; for disc playback, be sure to also press the adjacent "dbx DISC" button.



Power

Press in this button to turn ON the AC power to the 222; press again to release the button and turn power OFF. A red LED above the button is illuminated when the unit is ON.

dbx Disc

Press this button and the PLAY button when you want to listen to (decode) a dbx encoded disc (or when you want to simultaneously listen to an encoded disc while making an encoded tape recording of that disc). The red LED above the button is illuminated when set for disc decoding.

How to Use The Function Select Buttons on Your 222

NOTE: With RECORD, PLAY & BYPASS, push only one button at a time.

BUTTON(S) PRESSED IN				FUNCTION OBTAINED
RECORD	BYPASS	PLAY	dbx DISC	
●				**TO MAKE A dbx ENCODED TAPE** Program coming into the 222's "FROM PREAMP TAPE OUTPUT" jacks will be encoded and sent to the "TO TAPE RECORDER INPUT" jacks of the 222.
		●		**TO PLAY A dbx ENCODED PROGRAM** Program coming into the 222's "FROM TAPE RECORDER OUTPUT" jacks will be decoded and sent to the "TO PREAMP TAPE INPUT" jacks of the 222.
	●			**FOR NO PROCESSING OF THE TAPE** Program coming into the 222's "FROM PREAMP TAPE OUTPUT" jacks will be sent directly to the "TO TAPE RECORDER INPUT" jacks, and program coming into the 222's "FROM TAPE RECORDER OUTPUT" jacks will be sent directly to the 222's "TO PREAMP TAPE INPUT" jacks with no encoding or decoding.
		●	●	**dbx DISC/SOURCE DECODING** Program coming into the 222's "FROM PREAMP TAPE OUTPUT" jacks will be decoded and fed to the "TO PREAMP TAPE INPUT" jacks. (The encoded disc program fed to the "FROM PREAMP TAPE OUTPUT" jacks will also be fed to the "TO TAPE RECORDER INPUT" jacks without decoding.)

To Make a dbx-Encoded Tape Recording

1. Press in the dbx 222's RECORD button. (The dbx DISC button should be out.)
2. Place the tape recorder in Record mode, and adjust record level controls for an average level of −5 on average-reading meters. (For some tape recorders and under certain conditions, more precise settings are required. For more information, please refer to page 13, Tape Level Adjustment.)
3. Do not switch the 222 while making the recording.
4. If your tape recorder has 3 heads, and you wish to monitor the encoded tape as it is being made, you will be listening to the encoded program (the 222 can only perform one function at a time, encoding or decoding). This will verify that a recording is being made, but since encoded program is not particularly pleasant sounding, you may prefer to switch the preamp's TAPE MONITOR switch to SOURCE and listen to the unencoded program ahead of the 222.

To Play a dbx-Encoded Tape Recording

1. Set the preamp's TAPE MONITOR switch to TAPE.
2. Press in the dbx 222's PLAY button, and play the encoded tape. (The dbx DISC button should be out.)

To Play a dbx-Encoded Phonograph Disc

1. Press in the dbx 222's DISC and PLAY buttons.
2. Set the preamp's INPUT SELECTOR to PHONO, set its TAPE MONITOR switch to TAPE, and play the dbx-encoded disc.

To Make or Play a Conventional, Non-Encoded Tape Recording

1. Press in the dbx 222's BYPASS button. (The dbx DISC button should be out.)
2. Play the tape (or make the recording) as you normally had done before using the Model 222.

To Make a Non-Encoded Tape Recording from a dbx-Encoded Disc

1. Turn off the preamp and reconnect the 222 and tape recorder to the preamp as shown in Figure 4.
2. Turn the preamp on.
3. Press in the dbx 222's DISC and PLAY buttons.
4. Set the preamp's INPUT SELECTOR to PHONO, and set the TAPE MONITOR switch to TAPE.
5. You can monitor the recording of the decoded disc by listening through your loudspeakers.

INTRODUCTION

The tape recording process traditionally has been one of the major sources of noise in recorded music. The dbx tape noise reduction system virtually eliminates tape hiss. In addition, dbx processing permits recordings to be made at levels that avoid much of the distortion which normally occurs in tape recording. As a result, the dbx tape noise reduction system not only reduces noise, it can vastly improve tape recorder performance. With dbx processing, virtually the only noise heard on playback is that noise which was present in the original program. Taped records, upon playback, will sound just like the original disc, taped FM broadcasts, upon playback, will have no more noise than was present in the original reception of the program; and recordings of live music, conversation, and so forth, will be indistinguishable from the live event. These genuine improvements in the quality of tape recordings are due to a phenomenal increase in recordable dynamic range and the dramatic absence of tape-induced noise.

The dbx Model 222 has two channels of noise reduction processing, switchable as a pair for either encoding or decoding a stereo program. This dbx Type II system provides in excess of 30 dB broadband tape noise reduction with a simultaneous 10 dB improvement in headroom in the tape recording process.

The Model 222 also may be used to decode special dbx encoded phonograph discs. These discs, available through leading hi-fi and record dealers, are up to 40 dB quieter than a conventional disc, and provide tremendous musical dynamic range.

The 222's dbx disc decoding circuitry is not designed to reduce noise on conventional phonograph records. Neither can the 222's dbx tape noise reduction circuits reduce hiss on a tape which has already been recorded without the corresponding dbx processing during the recording process.

The dbx 222 is fully compatible with all other dbx Type II units, including the 224, Model 21, 120 series and 140 series. The 222 is not compatible with dbx Type I Professional equipment, and vice-versa. The difference between the two systems results from the design consideration for higher speeds and larger tape format used in live recording with professional equipment, and the corresponding slower speeds and smaller tape format used in home high fidelity equipment. This means that the Type II noise reduction system is superior for use with home high fidelity equipment.

Alone, the dbx 222 will dramatically improve the quality of your live tape recordings, and will preserve the quality when you are copying previously recorded programs.

When used properly, dbx tape noise reduction makes an extremely valuable addition to your sound system and to your listening enjoyment. This manual describes how your dbx 222 functions, and how you can obtain maximum benefit from its use.

Basic Signal Connections and Operation

CAUTION: Make sure that the power is OFF on all equipment when installing the dbx unit. As a further precaution, turn down your amplifier VOLUME control prior to switching on the dbx 222 for the first time. Inadvertent decoding of non-encoded programs (222 in PLAY mode) can create surging to high volume levels.

NOTE: Never connect any other electronic equipment between the dbx 222 and your tape recorder's inputs or outputs. This could cause inaccurate encode/decode tracking and loss of quality in the recorded signal.

The basic functions of the dbx 222 are presented in the Brief Operating Instructions on page 2.

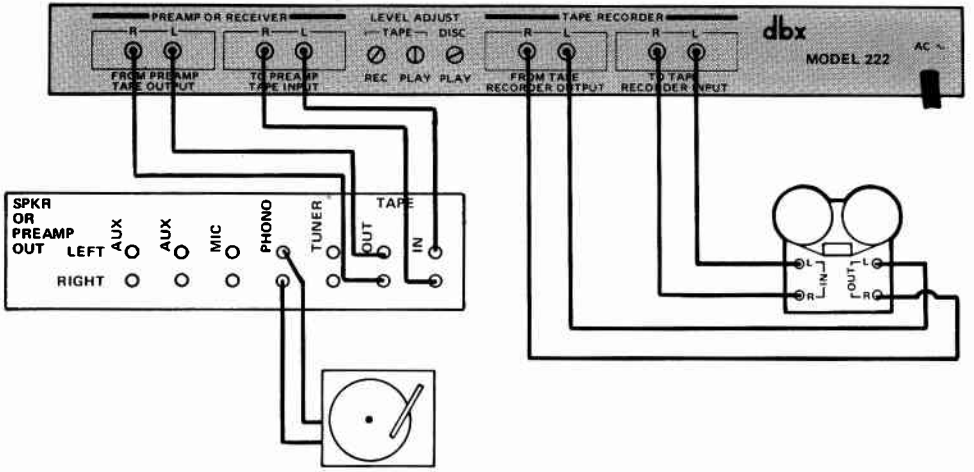


Fig. 3 — Basic signal connections to the dbx 222

Dubbing a dbx Encoded Disc onto a Tape in Encoded Form

This process allows you to preserve the low noise and wide dynamic range of the dbx noise reduction system when transferring an encoded disc to a tape. Such tapes are then played back through the Model 222 in the same manner as any dbx Type II encoded tape. No special connections are necessary (Figure 3).

1. Press in the 222's DISC and PLAY switches.
2. Set your preamp as follows: TAPE MONITOR switch to TAPE, and INPUT SELECTOR switch to PHONO.
3. Set your tape recorder to Record, and record normally.
4. The tape copy will be dbx encoded, and you will hear the program in decoded form while monitoring this operation.
5. After the tape is recorded, it can be played back in decoded form by releasing the 222's dbx DISC button. Leave the dbx PLAY button in, and the preamp TAPE MONITOR in TAPE position (or set its INPUT SELECTOR to TAPE).

Dubbing a dbx Encoded Disc onto a Tape in Non-Encoded Form

This process is for transferring a dbx-encoded disc in non-encoded form onto a tape for future playback without dbx processing (such as in an automobile tape player).

If your tape recorder is equipped for off-the-tape monitoring and you wish to listen to the tape as it is being recorded, you can plug a pair of headphones into the recorder's phones jack. Alternately, you can connect your tape recorder's PLAY OUTPUTS directly to your preamp's TAPE INPUTS (Monitor In), and set the preamp's TAPE MONITOR OR INPUT SELECTOR to TAPE mode. (See Figure 4.)

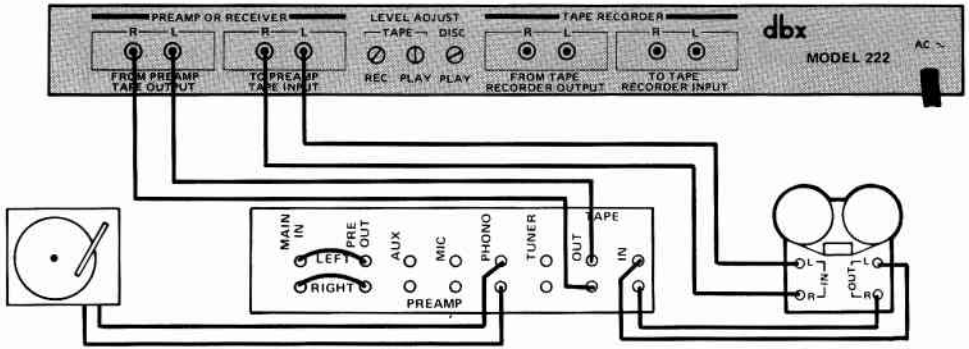


Fig. 4 — Connections for making a non-encoded recording from a dbx encoded disc.

Using the 222 in Conjunction with a Graphic Equalizer

If you use a graphic equalizer with your sound system, the equalization *must not* be introduced between the 222's TAPE RECORDER OUTPUTS and the tape recorder's inputs, or between the recorder's outputs and the 222's TAPE RECORDER INPUTS. Ideally the dbx 222 is installed in the preamp's tape monitor loop, and the graphic equalizer is installed between the preamp output and the power amplifier input as shown in Figure 5. Alternately, install the graphic equalizer in the preamp's tape monitor loop and place the 222 in the graphic equalizer's tape monitor loop, but *be sure to set the equalizer so it's effect comes after the dbx unit.*

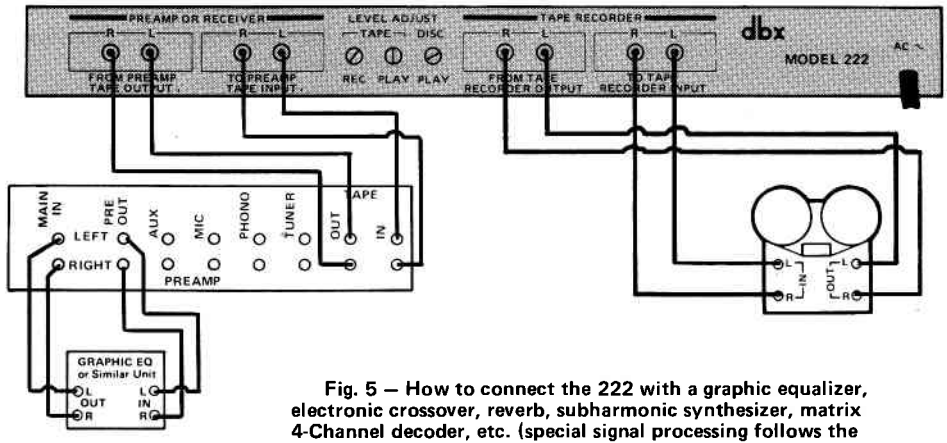


Fig. 5 — How to connect the 222 with a graphic equalizer, electronic crossover, reverb, subharmonic synthesizer, matrix 4-Channel decoder, etc. (special signal processing follows the dbx encode/decode process).

Using the 222 with an Equalized Speaker System

If you have an equalized speaker, such as most Bose speakers or Electro-Voice "Interface" series speakers, the dbx 222 can be connected in the speaker equalizer's tape monitor loop. The equalizer should be installed in the preamp's tape monitor loop as illustrated in Figure 6.

Copying a dbx-Encoded Tape

To make a dbx-encoded copy from a dbx type II encoded tape, follow the procedure depicted in Figure 7.

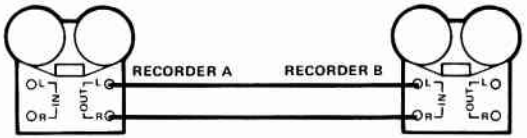


Fig. 7 — Copying dbx-encoded tapes or non-encoded tapes directly from one tape recorder to the other.

Since the encoded tape does not require additional dbx Type II processing in order to be copied, Tape Recorder "A" Play (Line) Outputs can be connected directly to Tape Recorder "B" Record (Line) Inputs.

Making a Non-Encoded Copy of a dbx-Encoded Master Tape

The encoded master tape must be dbx-decoded prior to feeding the slave tape recorder. This may be accomplished in either of two ways, depending on the nature of your sound system.

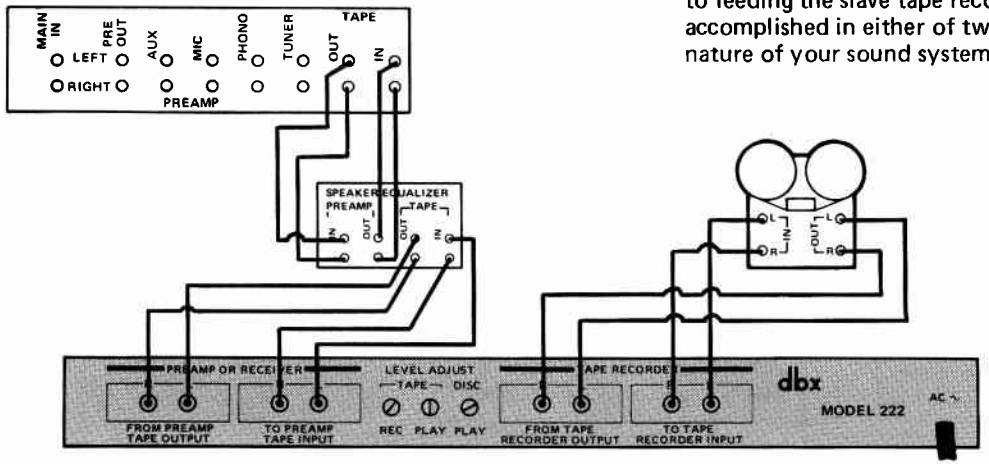


Fig. 6 — How to connect the 222 with an equalized speaker system. (dbx processing is done inside the tape monitor loop of the speaker equalizer, which itself is in the tape monitor loop of the preamplifier.)

For Sound Systems with Two Tape Monitor Loops:

If your preamp, amplifier or receiver has two tape monitor loops with switching for "Dub A to B" or similar copying provisions, no special connections are required (Figure 8).

1. Press in the 222's front panel PLAY switch. (The dbx DISC button should be out.)
2. Set your preamp to "Dub B to A" mode, set Tape Recorder "B" to Play mode and Tape Recorder "A" to Record mode.

For Sound Systems with One Tape Monitor Loop:

If your preamp (or receiver) has only one tape monitor loop, here is the way to make a non-encoded copy:

1. Simultaneously connect the 224's PREAMP TAPE MONITOR OUTPUTS to the preamp and Tape Recorder B's Inputs by using "Y" adapters (Figure 9A).
2. Press in the 222's front panel PLAY switch.
3. Set the Tape Recorder "A" to Play mode and Tape Recorder "B" to Record mode.

A Method Using No Preamp & No Special Cables:

If you prefer, you can make a non-encoded copy of an encoded tape with only the two tape machines and the 222.

1. Tape Recorder A's output should be connected to the dbx 222 TAPE RECORDER input, as usual. Connect the 222's PREAMP TAPE MONITOR OUTPUTS not to the preamp's Tape Monitor Inputs, but instead to the Tape Recorder B's Record Inputs (Figure 9B).
2. Press in the 222's front panel PLAY switch.
3. Set the Tape Recorder "A" to Play mode and Tape Recorder "B" to Record mode.

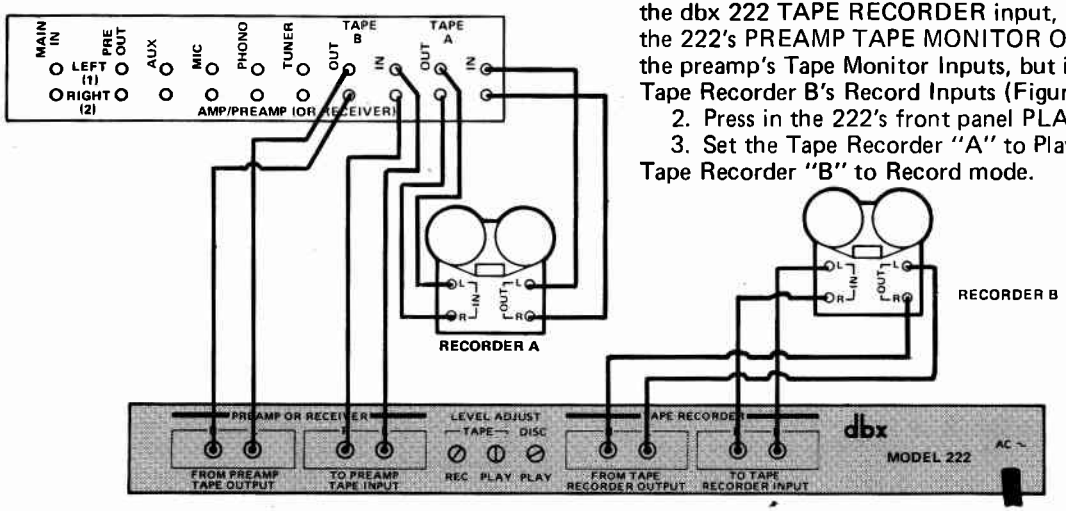


Fig. 8 — Copying dbx-encoded and non-encoded tapes with a preamp having two tape monitor loops.

Making a dbx-Encoded Copy from a Non-Encoded Tape

For Sound Systems with Two Tape Monitor Loops:

If your preamp has two tape monitor loops with switching for "Dub A to B" or similar copying provisions, no special connections are required. The installation is the same as that shown in Figure 8; again, Tape Recorder B is copied from; Tape Recorder A records the encoded signal. The only difference is in the 222 switching.

1. Press in the 222's RECORD switch.
2. Set your preamp to "Dub B to A" mode, set Tape Recorder "B" to Play mode, and Tape Recorder "A" to Record mode.

For Sound Systems with One Tape Monitor Loop:

If your preamp has only one tape monitor loop, follow this procedure.

1. Connect Tape Record B's Outputs to an auxiliary input on your preamp.
2. Place the tape to be copied on Tape Recorder B. (If this is not possible, reverse your two tape recorders and redesignate them so that Tape Recorder A is hooked up to the 222.
3. Press in the 222's front panel RECORD switch.
4. Select auxiliary mode on the preamp.
5. Set Tape Recorder "B" to Play mode, and Tape Recorder "A" to Record mode.

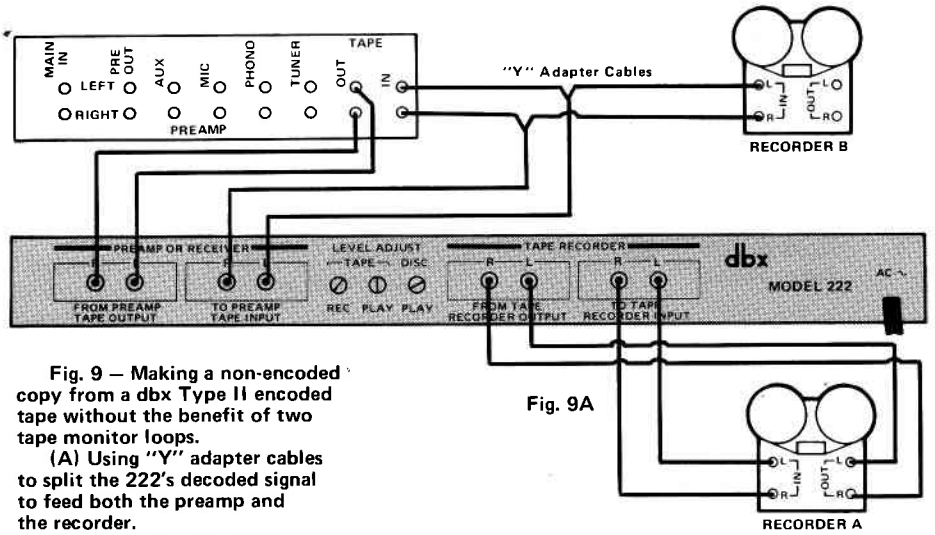


Fig. 9A

Fig. 9 — Making a non-encoded copy from a dbx Type II encoded tape without the benefit of two tape monitor loops.

(A) Using "Y" adapter cables to split the 222's decoded signal to feed both the preamp and the recorder.

(B) Using standard cables, and no preamp at all.

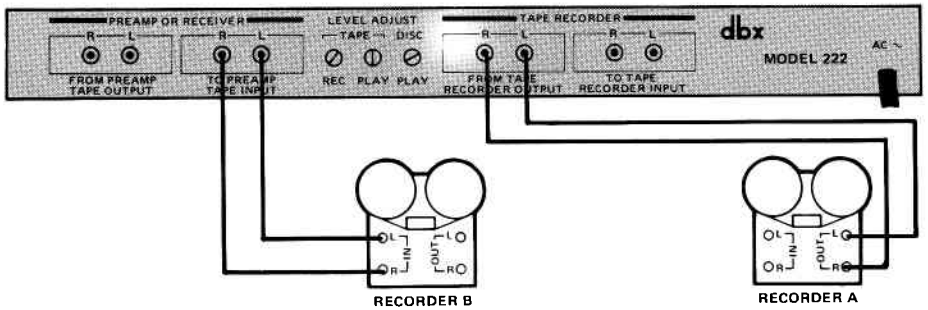


Fig. 9B

SETTING THE LEVEL ADJUST CONTROLS

For listening convenience, three screwdriver-adjustable controls are provided on the rear panel. They are intended to keep the record and playback levels about the same, and to optimize level matching between your preamp, recorder, and the dbx 222 for the best headroom and lowest noise. The controls are factory preset to provide the desired results in most installations. Each control adjusts two channels simultaneously, so proper stereo balance is maintained. In no case does their setting affect the linearity of the dbx encode/decode process.

Tape Record Level Adjustment

1. Connect a source of a typical musical program at fairly constant level to your preamp; preferably a record or an FM radio broadcast. Set the preamp's TAPE MONITOR switch to source. (If you have an audio oscillator or test record, you can use a *1 kHz tone* at standard reference level.)
2. Press in the 222's BYPASS switch (dbx DISC button out).
3. Setup your tape recorder for recording, but do not record a tape (use the recorder's PAUSE switch). Play the source (i.e., program or test tone) through your system at an average listening level and adjust the tape recorder's input level controls. With program material, the *peaks* should reach +3 dB on the peak-reading meters of a reel-to-reel recorder or −8 dB to 0 dB on a cassette recorder. With *average* VU meters, the readings should be −10 dB to 0 dB for reel-to-reel and −12 dB to −3 dB for cassette recorders. (A test tone can be set within the range of average levels indicated above.) Remember these levels will vary depending on whether your tape recorder has peak reading meters or average reading meters. You will find that by experimenting with different recording levels, for different types of music or different types of recording tape, you can achieve better results and full enjoyment of the dbx II recording system.
4. Now press in the 222's RECORD switch.
5. Without touching any of the recorder's level controls, adjust the 222's rear panel LEVEL ADJUST "TAPE REC" control so that your recorder's VU meters read about the same as they did with the dbx unit switched to BYPASS.
6. From now on, adjustments of recording level will be made with the recorder's input level controls.

Tape Play Level Adjustment

This adjustment is provided so you can use about the same preamp VOLUME control setting whether you are playing a conventional tape (222 BYPASS switch pressed in) or a dbx encoded tape (222 PLAY switch pressed in).

For this adjustment, you will need any good quality dbx Type II encoded tape or, alternately, a source of a 1 kHz test tone. Since the adjustment is for listening convenience only, if you do not have a tone source or a dbx encoded tape, you can delay the adjustment until after you record a dbx encoded tape.

1. Press in the 222's BYPASS switch (dbx DISC button out).
2. Set your preamp TAPE MONITOR Switch to TAPE.
3. Play a dbx Type II encoded tape on your recorder. You can use a tape of program material with fairly constant level. For more accurate settings, you can use a tape recording of a 1 kHz tone at −3 VU to 0 VU recorded level.

NOTE: A 1 kHz tape recording can be made using an oscillator or a test record as a signal source. If the 1kHz

tone is used, it makes no difference whether or not the tape is dbx Type II encoded.

4. Adjust the 222's LEVEL ADJUST "TAPE PLAY" control so that on louder program passages, when the 222's BYPASS and PLAY switches are alternately pressed in, the levels are approximately the same (or so that the 1 kHz tone remains at the same volume level when switching between BYPASS and PLAY).

NOTE: Due to changes in frequency response caused by pre-emphasis and de-emphasis in the dbx encoding process, concentrate on midrange frequencies (e.g., vocals) when making this comparison.

Disc Play Level Adjustment

This adjustment is provided so you can use about the same preamp VOLUME control setting whether you are playing a conventional phonograph record (preamp Tape monitor switch not engaged) or a dbx encoded disc (preamp Tape monitor switch engaged and 222 DISC and PLAY switches pressed in).

1. Press in the 222's DISC and PLAY switches.
2. Set your preamp as follows: INPUT SELECTOR switch at PHONO; TAPE MONITOR switch at TAPE.
3. Play a dbx encoded disc on your phonograph.
4. Adjust the 222's rear panel LEVEL ADJUST "DISC PLAY" control so that, on moderately loud passages, the levels are approximately the same when the preamp's TAPE MONITOR switch is alternately moved between SOURCE and TAPE.

NOTE: Due to changes in frequency response caused by pre-emphasis and de-emphasis in the dbx encoding process, concentrate on midrange frequencies (e.g., vocals) when making this comparison.

dbx PRODUCT WARRANTY & FACTORY SERVICE

All dbx products are covered by a limited warranty. Consult your warranty card or your local dealer for full details.

The dbx Customer Service Department is prepared to give additional assistance in the use of this product. All questions regarding interfacing dbx equipment with your system, service information or information on special applications will be answered. You may call during normal business hours — Telephone: 617-964-3210 Telex: 92-2522, or write to:

dbx, Inc.
71 Chapel Street
Newton, MA 02195
Attn: Customer Service Department

Should it become necessary to have your equipment factory serviced:

1. Please repack the unit, including a note describing the problem along with the day, month and year of purchase.
2. Send the unit, freight prepaid, to:

dbx, Inc.
224 Calvary Street
Waltham, MA 02154
Attn: Repair Department

3. We recommend that you insure the package and send it via United Parcel Service wherever possible.
4. Please direct all inquiries to dbx Customer Service Department.

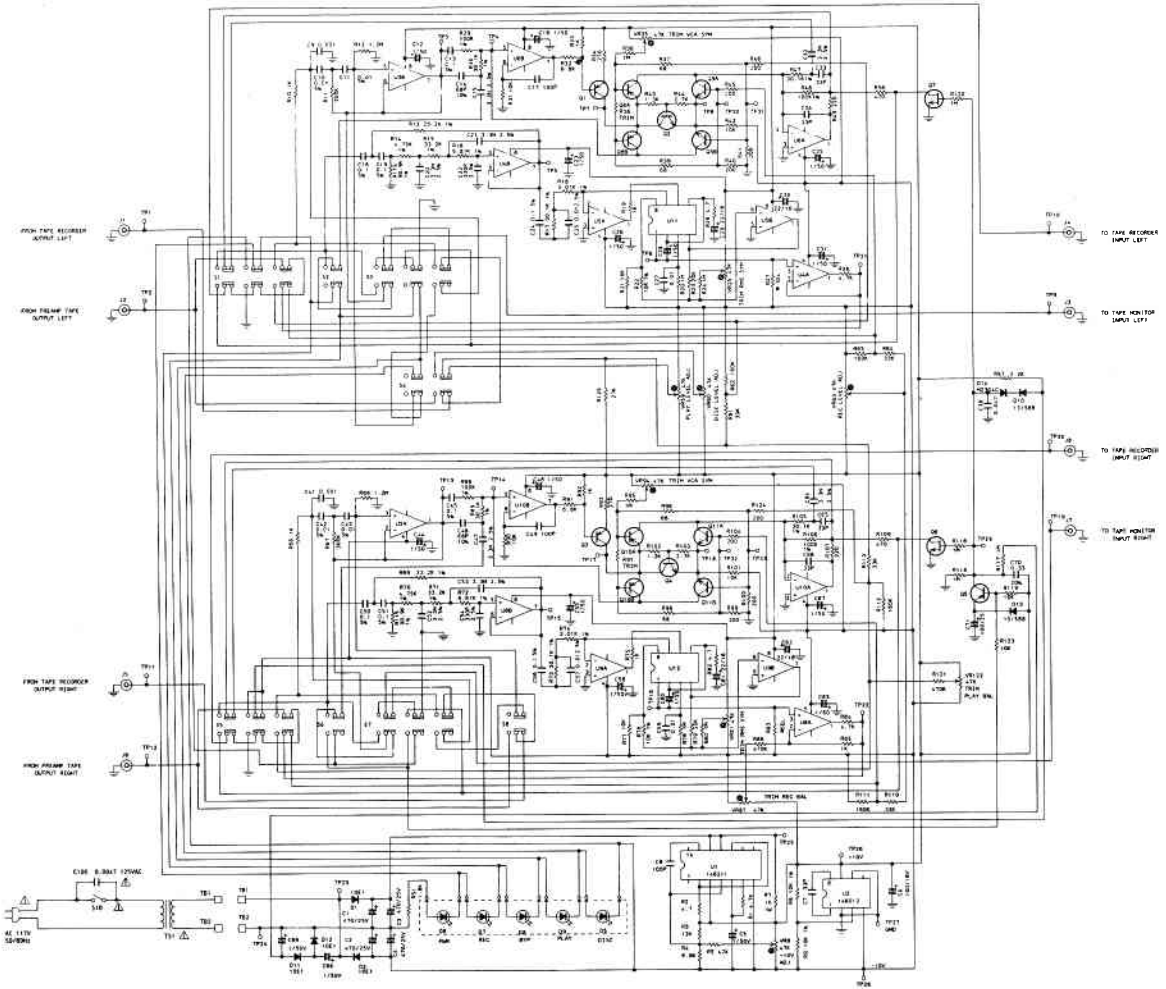
Outside the U.S.A.– contact your nearest dbx dealer for name and address of the nearest authorized repair center.

SPECIFICATIONS

EFFECTIVE NOISE REDUCTION	30 dB, plus 10 dB headroom; 40 dB for dbx-encoded discs (A weighted).
DYNAMIC RANGE	110 dB (peak signal to weighted background noise).
INPUT IMPEDANCE	100 kohms (designed to be driven from source impedance of less than 10 kohms).
INPUT LEVEL	Nominal, 300 mV RMS; Maximum, 6 V RMS.
OUTPUT IMPEDANCE	100 ohms (designed to drive 5 kohms or greater).
OUTPUT LEVEL	Maximum, 5.5 V RMS (5 kohm load).
FREQUENCY RESPONSE	±0.5 dB, 40 Hz to 20 kHz, −1 dB at 30 Hz (encode/decode, typical program material tracking).
SLEW RATE	Greater than 10 V/microsecond.
EQUIVALENT INPUT NOISE	−85 dBV (unweighted, 20 kHz bandwidth, referenced to 1 V).
TOTAL HARMONIC DISTORTION	Less than 0.5%, 30 Hz – 100 Hz; Less than 0.1%, 100 Hz – 20 kHz (encode/decode).
INTERMODULATION DISTORTION	Less than 0.2% (SMPTE).
POWER LINE REQUIREMENT	117 V AC, 50 to 60 Hz. Consult factory for non-U.S. line voltages.
POWER LINE CONSUMPTION	5.5 W.
SIZE	17-1/4" W x 1-3/4" H x 7-1/8" D (43.8 cm x 4.4 cm x 18.1 cm) Rack mount hardware supplied to adapt unit for standard 19" (48.3 cm) rack.

Specifications are subject to change without notice.

SCHEMATIC



NOTES
UNLESS OTHERWISE SPECIFIED
(1)RESISTORS ARE 1/4W IN OHMS(K=1000). ±5%(J).
(2)RATED VOLTAGE OF STYROL,MYLAR AND DISK CAPACITORS ARE D.C50V.
TOLLERANCE ARE AS MENTIONED BELOW.

MYLAR, CERAMIC AND STYROL ±5%.
DISK CERAMIC ±0.25PF(LESS THAN 5PF)
±0.5PF(8PF 9PF), ±5%(10PF 820PF)
±10%(GREATER THAN 1000PF)

(3)ALL OP AMPS ARE P/N 146241 (LF353).
(4)Q1.Q3 ARE P/N 142091
Q2.Q4 ARE P/N 142081
Q8.Q10 ARE PNP.P/N 142151
Q9.Q11 ARE NPN.P/N 142151
U11.U12 ARE TRANSISTOR ARRAY.P/N 148221
(5)S1.S5 • REC
S2.S8 • BYPASS
S3.S7 • PLAY
S4.S6 • DISC
(6)(C29-R27) (C61.R83) SELECT PER DRAWING #184013

dbx® inc.

71 Chapel Street
Newton, MA 02195

Manufactured under one or more of the following U.S. patents: 3,681,618; 3,714,462; 3,789,143; 4,101,849; 4,097,767. Other patents pending.

1280 2.2M-600162 Printed in Japan
R-783A