

**dbx**

Model 3BX  
Digital Series

Dynamic-Range Controller

Instruction Manual

## INSPECTION and INSTALLATION

Your unit was carefully packed at the factory in a protective carton. Nevertheless, be sure to examine both carton and contents for any signs of damage that may have occurred during shipping. If there is such evidence, don't destroy the carton or any of the packing material, and notify your dealer or distributor immediately.

In any case it's a good idea to save the carton and packing materials should you ever need to ship your unit in the future.

In addition to a 3BX-DS and this instruction manual, the carton should contain a set of hookup cables with RCA phono, or pin, plugs, a warranty/registration card, and a pair of brackets for mounting the unit into a standard audio-equipment rack.

No special cooling or ventilation is required in any installation; other components may be stacked above or below the 3BX provided they don't generate excessive heat.

### WARNING

TO PREVENT FIRE OR SHOCK HAZARD,  
DO NOT EXPOSE THIS COMPONENT  
TO RAIN OR MOISTURE.

This triangle, which appears on your component, alerts you to the presence of uninsulated dangerous voltage inside the enclosure -- voltage that may be sufficient to -- constitute a risk of shock.



This triangle also appears on your component, and it alerts you to important operating and maintenance instructions in this accompanying literature.

### CAUTION

To Reduce Further the Risk of Shock, Do Not Remove the Cover or Back. There Are No User-Serviceable Parts Inside; Refer All Servicing to Qualified Personnel.

“dbx” and “OverEasy” are registered trademark of dbx, Inc., Newton, Mass. USA.

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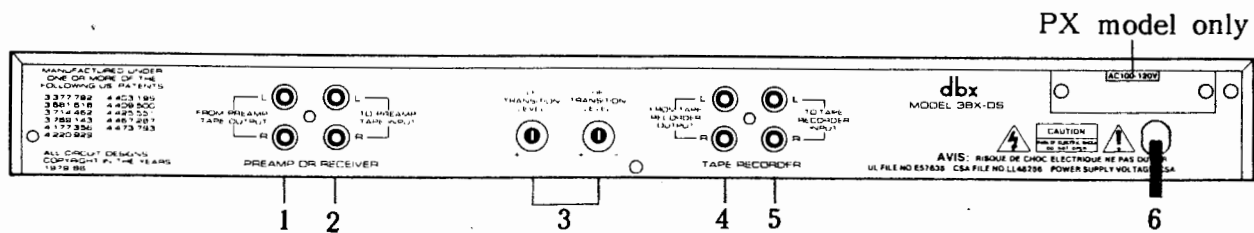
## SPECIFICATIONS

Expansion . . . . .	To 50% increase, maximum 12 dB upward and 20 dB downward; three bands (200 Hz and 4 kHz crossovers for all signal-processing functions)
Impact recovery. . . . .	To potential +10 dB (upward only), program-dependent; three bands
Compression . . . . .	OverEasy, from none to 2:1, three bands, maximum 6 dB of gain
Ambience . . . . .	Adds or subtracts L-R/R-L @ around 1 kHz, with decreasing effect toward bass and treble
Transition level . . . . .	Set at 200 mV, ranges from 70 to 600 mV
Frequency response, no expansion . . . . .	+0.5 dB 20 Hz-20 kHz
Dynamic range. . . . .	Variable 101-115 dBV (below 1 V)
Total harmonic distortion (THD) . . . . .	0.15% any setting
Intermodulation distortion (IMD) IHF or SMPTE . . . . .	0.1% any setting
Equivalent input noise. . . . .	-90 dBV with no compression or expansion
Attack and release rates. . . . .	Program-dependent, optimized
Maximum input and output . . . . .	6 V

### Notes

- 1) Specifications are subject to change.
- 2) All data are for 20 Hz-20 kHz unless otherwise specified; line inputs are driven by a source impedance of 1 k-ohms and outputs are loaded by 10 k-ohms in parallel with 1000 pF; all voltages are rms (root-mean-square).
- 3) Dynamic range is defined as the difference between the maximum 1-kHz rms output signal and A-weighted noise. All noise figures are A-weighted.
- 4) Frequency-response figures are for pink noise.
- 5) SMPTE IMD is measured with 60 Hz and 7 kHz mixed 4:1; IHF (difference-tone) IMD is measured with 19 kHz and 20 kHz mixed 1:1; output 1 V.
- 6) Inputs and outputs have identical polarity.
- 7) All dbx home products are designed to be used with components whose output impedance is less than or equal to 5 k-ohms. All units are designed to drive loads of at least 5 k-ohms in parallel with 1000 pF or less.

## REAR CONNECTIONS



Turn your system off and the volume all the way down.

"Preamp" stands for your preamp, receiver, or integrated amp -- or the tape-monitor (record/play) loop of an equalizer or other component. The 3BX-DS has its own tape monitor to replace the one it occupies.

- 1 FROM PREAMP TAPE OUTPUT. Connect your preamp's Tape Out to these inputs.
- 2 TO PREAMP TAPE INPUT. Connect these outputs to your preamp's Tape In. (Note that with some components Tape Out is called Tape Rec and Tape In is called Tape Play or Tape Monitor, and there are other variations.)
- 3 LF and HF TRANSITION LEVELS. These screwdriver controls alter bass (LF) and/or treble (HF) tonal balance for the 3BX's expansion and, to a lesser extent, for its compression. You can turn them to make the sound brighter or duller, bassier or thinner, according to taste and program material. They come set to a nominal sonic value, however, which you may well find suitable most or all of the time. They do not affect the Impact Recovery or Ambience circuits. Also see the discussion pp. 4-8.
- 4 FROM TAPE RECORDER OUTPUT. Connect your tape deck's Output (or Play) to these inputs.
- 5 TO TAPE RECORDER INPUT. Connect these outputs to the Input, Line In, Rec(ord) or whatever on your tape deck.

If you have a dbx noise-reduction unit or other signal-processing equipment, study the second diagram following. As you've noticed, hookup choices are also screened onto the top of your unit.

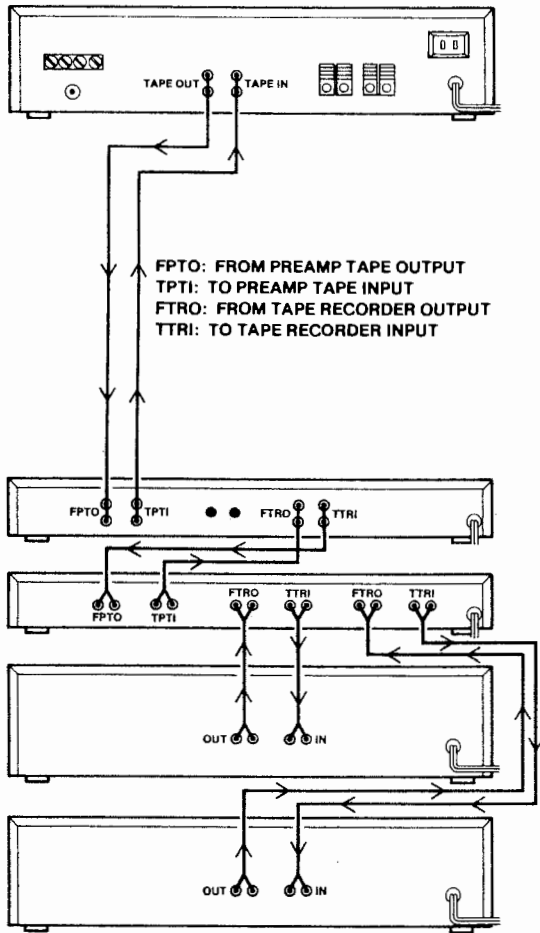
- 6 POWER CORD. Connect this cable to the appropriate power source. If another piece of equipment has a switched outlet (your preamp, for instance), that's one good place to plug in.

For PX model only

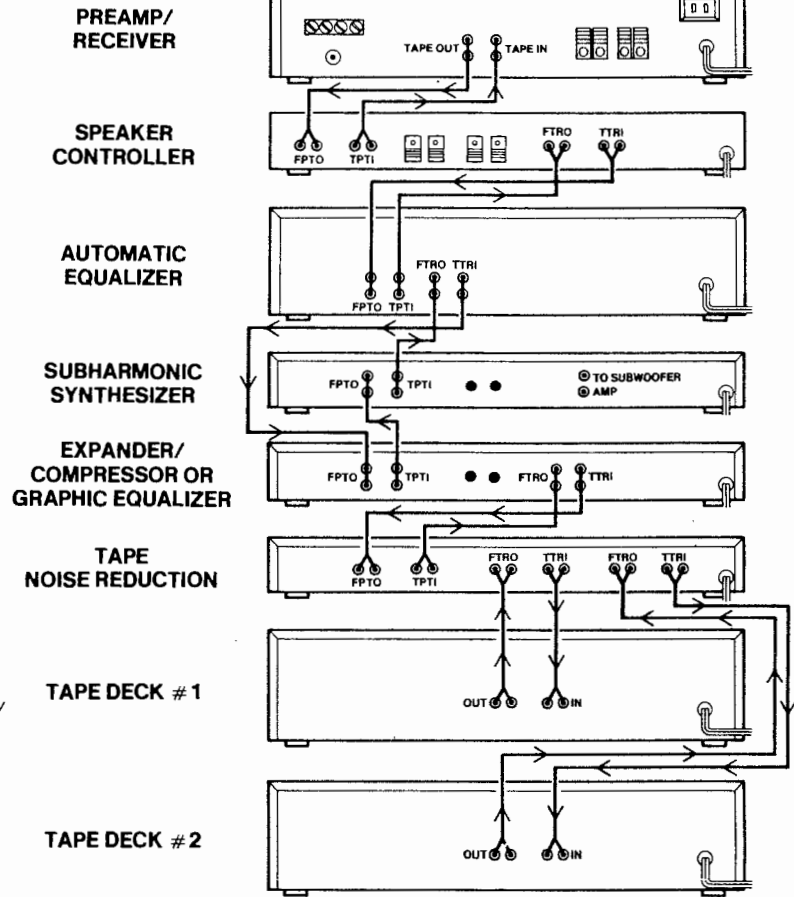
If you ever need to change the voltage setting, unplug the unit from the wall jack and also push the power switch off. Then unscrew the small voltage cover plate near the ac cord, move the switch with a small screwdriver, turn the plate upside down (180°, in other words, which exposes the switch in its new voltage position), and screw it back on. Don't turn the plate over.

## TYPICAL HOOKUPS

### SIMPLE HOOKUP



### COMPLEX HOOKUP



### Basic Signal Connections

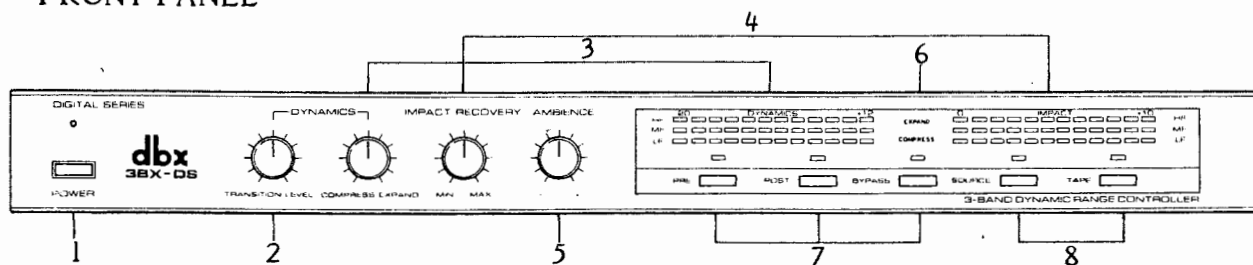
The 3BX-DS goes between the preamp and the tape deck, in the former's tape-monitor loop, as shown. The tape deck then goes in the 3BX's tape loop.

### Using the 3BX-DS with a dbx Noise-Reduction System and/or other components

The 3BX usually comes first in the hookup (and last in the signal path except for an automatic or dedicated speaker equalizer). Connect the 3BX directly in one of the tape-monitor loops of the preamp, as shown. Then connect the noise-reduction unit directly in the 3BX tape loop. Finally, the deck itself goes directly in the noise-reduction unit's tape-monitor loop. Red plug = right channel.

Those whose stereos approach this complexity should investigate the dbx 200 and 400 series Program-Route Selectors.

## FRONT PANEL



1 POWER. Push this button to turn the unit on and off.

### DYNAMICS

2 TRANSITION LEVEL. This knob sets the midpoint of the processing action, the level above and below which the circuits do their stuff.

For expansion, we suggest turning it so that the LEDs glow about equally, the red ones during loud parts of the music and the yellow LEDs during quiet parts.

For compression, it depends on your sonic goals. If you want to tame peaks, turn it rightward. If you want to leave peaks relatively alone and just bring up the soft passages, turn it leftward. If you want to do both, leave it centered. This knob is mostly for your convenience in adjusting overall levels; its positioning is not critical to performance.

3 COMPRESS/EXPAND knob and three LED rows. Turn this knob leftward to control the amount of compression. Compression makes loud passages quieter and quiet ones louder; this is useful for background listening and making car cassettes, especially when CDs are the source. Full rotation cuts the dynamic range of the program in half without unpleasantly constricting or "holding back" the sound.

Turn the knob rightward to control the amount of expansion, making loud passages louder and quiet ones quieter. A setting at the first increment line, or 10%, increases the program's dynamic range by that amount; the fourth line increases dynamic range by 40%; and so on. In this latter case an input signal with 40 dB of dynamic range will be expanded to 56 dB and a signal with 50 dB of dynamic range will be expanded to 70 dB. As the LED row shows, the maximum is 12 dB of upward, or louder, expansion and 20 dB of downward, or softer, expansion.

4 IMPACT RECOVERY knob and LED rows. Turn this knob rightward to add impact to transients -- the attack at the beginning of a drum beat, for example. Such punch added to musical attacks gives them greater "liveness." If the music calls for it, the amount can be up to +10 dB, as shown. The amount you'll want to add and the effect on the sound vary from source to source, as we'll discuss presently.

5 AMBIENCE. This knob controls the amount of channel-difference information, letting you change the spaciousness of the sound.

Turn it to the left (-) to tighten the stereo image; the channels get blended (L+R) in the midrange and, decreasingly, in the treble and bass. Leftward settings will accentuate the centeredness of an ensemble, for example. Turning the knob to the right (+) opens up the image by adding in stereo-difference information, which usually will increase the ambient spaciousness around the music, as for symphonic works. Either way, it can sound as if you're modifying the mike placement or the mix of a recording. Some master tapes as revealed by the CD format sound better with added difference information: they have more "airiness." But whatever your source material, it's instructive and fun to play with this knob's settings.

6 LED DISPLAY. In both Compress and Expand modes, gain increases are shown by red LEDs (to the right) in the Dynamics section of the display and gain decreases by the yellow LEDs (to the left).

Gain increases consist of either above-threshold upward expansion (the threshold being set by the Transition Level) or below-threshold compression. In the latter mode, note that since the compressor cannot provide more than 6 dB of below-threshold gain, not all of the red LEDs will be lit.

Gain decreases consist of either below-threshold downward expansion or above-threshold compression.

Impact Recovery, in the bass, midrange, and treble, is shown by its own 3-band display.

7 PRE, POST, and BYPASS. These first two buttons choose where the 3BX actions take place with respect to your tape deck -- before it (during recording) or after it (during playback). Bypass takes all the processing circuits out of the signal path altogether.

Push Pre to expand the program before you tape it (the deck in its Record mode, of course); you'll be recording a signal modified according to your taste. It can be compressed for car cassette playback, with or without added ambience and/or impact. Or it can be an expanded, "punched-up" signal with or without added ambience and/or impact, yielding a tape that actually sounds better -- quieter, more dramatic -- than the original.

Push Post for expansion on playback only (which is probably the more common application). Compress CDs for background listening; add ambience to dry, shallow, "flat-sounding" recordings or to tighten up overly reverberant ones; "unlimit" the transients of overly processed recordings and FM; and so on.

When you do decide you want to expand and/or add impact to the program before taping, watch your recording levels. Signals with extra dynamic range and impact are extremely hard for cassettes to handle, so be prepared to back off on your meter peaks and/or on the amount of expansion and impact restoration. It's very easy to saturate the tape and get distorted sound, especially with impact recovery on and levels that aren't conservative enough. Using dbx noise reduction will help because it can give you more room than the other two systems.

8 TAPE and SOURCE. These buttons control the program you listen to. Push Source to hear your CD player, radio, record player, or Auxiliary inputs (e.g., TV/VCR). Now you can compress/expand/add impact to these programs, as you wish. Push Tape to listen to your deck's playback and to "access" (bring into the signal path) any processors connected in the 3BX's tape loop. If your deck has monitoring ability (three heads), you can check a tape being recorded by comparing Source and Tape.

## COMPRESSION, EXPANSION, IMPACT RECOVERY, AMBIENCE, and DYNAMIC RANGE

### Compression

Everyone appreciates the silent background, extraordinary clarity, and unstrained peaks of compact discs. For serious listening at high levels, this wide dynamic range permits an unprecedented feeling of liveness or you-are-there-ness to the sound, as if we're actually present while the tape rolls at the recording session.

But for other situations -- background listening, or while reading -- who needs all this dynamic range? If you bring up the quiet passages, the loud moments will shake the room, and if you keep the peaks tolerable, you lose all the low-level detail. Furthermore, for taping with non-dbx noise reduction (which means relatively limited dynamic range for the tape deck) and for making cassettes for your car (where much of the wide dynamic range is lost to road and engine noise), a compressor is mandatory.

dbx is the compressor leader in the pro audio world. We make the best-selling and best-sounding compressors, using our famous OverEasy (gradual-onset) circuits. So who else would reintroduce a compressor for home use -- and one that doesn't produce the held-back feeling you get with other compressors? (Find the loudest pop FM station in your dial and you'll probably hear what we mean by this held-back, constricted feeling.) Moreover, the 3BX-DS compressor doesn't add noise or hiss of its own to the CD or to any other program sources, although in making soft passages louder it may also make their "noise floors" audible. Basically, the 3BX-DS just retrieves the quiet music at low levels and makes the loud peaks a little less fierce. It lets you control this wonderful new digital medium.

The technically minded will want to know that the 3-band 3BX compressor has variable gain below threshold (set by the Transition Level knob) and professional OverEasy compression with variable ratio above. The action is as follows: at full compression, the dynamic range of the program material is cut in half (2:1 compression ratio) above threshold, and below threshold (lower-level passages) the signal is boosted 6 dB. Intermediate settings yield intermediate figures, of course: with the knob at 9:30, compression is 1.5:1 and low-level gain is 3 dB. Experiment with amounts of compression in conjunction with the Transition Level setting, as suggested on page 4, to see what sounds best with various kinds of music and different listening or taping situations.

Note that compression is also useful for non-CD sources, that is, wherever the musical dynamic range is greater than you need for background listening or car taping -- low-level classical or jazz FM (not pop and rock, probably), wide-range video or TV playback, and non-pop LPs as well.

### Expansion

Let's now take a basic look at dynamic range, the difference in level between the loudest and softest sounds in any given musical performance or recording. Dynamic range customarily is expressed in decibels (dB), a standard unit that expresses a small relative difference in power or sound level.

In a performance, the loudest sounds are limited by the musician's ability to strike, bow, or blow into his or her instrument; by its own limitations (e.g., a pipe organ); or, with amplified music, by the amp/speaker system's ability to play loudly without objectionable distortion. Depending on how they're defined (how fast the measurement is) and on what kind of material is being played, so-called peak levels may be 5 to 15 dB above the average level. Unamplified music may have true instantaneous peaks of 115 dB SPL



(sound-pressure-level, a standardized measurement) and up; amplified music can be higher yet -- dangerously so. At the quiet end, 0 dB SPL is the figure customarily given for the threshold of human hearing in the most sensitive frequency range of 2-5 kHz. The dynamic range of human hearing at its best, then, may be said to be 120 dB or more. The dynamic range of musical performance is not much less, for even if the background is noisy, we can easily hear some tones and instrumental reverberation die out below it. 110 dB or so may be a reasonable maximum figure, although it's a rare performance and piece (and performance setting) that would qualify.

The advent of digital and optimized analog recording and sound reproduction has made us all more aware of these physical facts, and of how absolutely stirring clean peaks and silent backgrounds can be -- even though a large number of CDs or the master tapes they're made from are deliberately reduced in dynamic range (compressed). Most of us listen most of the time to reproduced music and musical media that have dynamic ranges of 65-70 dB at very best but more often 55 dB and less.

If we want to help restore whatever may have gotten lost in the manipulations of getting the sound from the performance to our listening rooms, an expander is required, and your 3BX-DS (which anyway is much more than an expander) will go a long way toward undoing the damage. As an expander and impact recoverer, it does the opposite of what happened in the first place. And because the 3BX-DS is a perfectionist's expander, dividing the audio frequency range into three bands and processing each separately (one band for high frequencies, one for middle, and one for lows), it can expand complex program material with virtually none of the potential artifacts -- audible clues -- that let the listener know the processing is taking place. With Impact Recovery and Ambience, which we'll get into presently, the end result of expansion is that the excitement of the original is more closely approximated, and the involvement of listening to music live is brought closer to home.

By lowering the noise and by increasing the forcefulness of the dramatic moments, then, a 3BX-DS will give new life to LP and tape collections and can make broadcasts worth listening to closely. And when used carefully with dbx noise reduction, a 3BX-DS lets you make tapes that actually sound better than the originals.

In general, the amount of expansion to use is a matter of taste. However, some guidelines might prove useful as you experiment with different material and sources. (Try combinations with Impact Recovery, too, of course.)

Classical music, for example, probably will benefit most from moderate expansion. Each knob incremental marking is 20%; you might want to start at 10% or less and range up to 25% for most classical material, depending on the music, the dynamic range of the master tape, and the medium (CD, simulcast, LP, etc.). Using too much more than these amounts will make a lot of classical music surge unnaturally, for usually it hasn't been severely compressed.

Popular music, especially as broadcast over FM stations, can use much more expansion much of the time -- say, from 10% for material with good dynamic range to 40% and above for material whose loudness levels hardly differ. Sometimes this music gets so compressed that full expansion by your dbx unit won't be enough, really, but improvement still will be marked.

With jazz you might want to start somewhere between these classical and pop settings, although a quiet and well-recorded small acoustic combo won't need much expansion at all.

Non-CD and even non-stereo-LP sources (regardless of the program) often are badly constricted in dynamic range. We mentioned pop FM, and the same frequently is true of the audio from VCRs, video discs and cassettes, and TV tuners and station transmissions in the first place -- although FMX (dynamic-range expansion for FM stereo) and MTS (stereo TV, the new technology for which dbx is responsible in conjunction with Zenith) represent audio breakthroughs for those media. Much of the time, unamplified music sounds squashed in those formats unaided, so a 30% 3BX expansion setting might be the place to begin.

### Cautions

Any expander will make greater demands of your power amplifier and loudspeakers; that's its job. But some people worry that they have to upgrade their amp when they buy an expander, and this is not usually the case. Wait and see how things sound over time. Whether a given amp is powerful enough isn't always easy to determine, for it depends on, among other things, loudspeaker sensitivity, the distortion characteristics of the amp, room size, and your listening-level habits. Fortunately, huge capacities in your components aren't essential for enjoyment of the 3BX-DS, and more often than not you'll be using your expander at less than the full, 50% setting and it will be on music that won't stress your equipment.

And if overdriving -- the excessive distortion of amp clipping and/or speaker breakup -- is the result at higher sound levels with reasonably good speakers and a healthy amp, it probably will be noticed only with material that has a good dynamic range to begin with, music that actually didn't need that much expansion. In which case what's called for is a reduction in the expansion setting, not more-powerful equipment.

### Impact Recovery

A great many CDs today -- virtually all pop ones, for example -- are still produced from analog master tapes. This almost invariably means that loud transient attacks, as of percussion, have been at least a little limited or compressed during the recording of the master tape, sometimes more than a little. Other times they get clipped by the saturation of the tape itself. The unique dbx Impact Recovery circuit, a fast-acting design (also three-band) covering the full range of audio frequencies, can help recover these lost peaks, up to a potential +10 dB, depending on the program. Furthermore, 16-bit PCM (pulse-code modulation) recording, which is what must be used at some point to fit the music into the CD format, is still not wide enough in dynamic range to capture everything successfully. A kick drum or a brass blast, for example, can produce SPLs whose initial impact up close is much greater than 110 dB. (That's why dbx has invented two new digital technologies, CPDM and 18-bit PCM, with dynamic range more than 10 dB greater than 16-bit PCM.) The only way to capture these sonic thrills in the maximum high-90s dynamic range of the 16-bit standard is to keep the mike back or use a compressor/limiter between the mike and the PCM recorder. The brass and kick-drum attacks we hear on CDs are plenty powerful, true -- but not really as much as when experienced live.

As for non-CD sources, the CD era has made all of us acutely aware of how music works its myriad effects on us. And today more than ever, when listening to FM, video, and LPs we miss the drama that crisp, full-power transients impart to the audio experience.

For example, in one respect music works largely through anticipation: our pleasure in knowing, but not knowing precisely, what's going to happen next. From fugue to 12-bar blues, one's expectations should be satisfied -- but not too predictably. Over time, in a good piece of music, the startling becomes familiar even as the familiar stays startling.

The attack of a note or chord can help enhance this freshness. Depending on the instrument and the preceding sounds, these initial transients may have terrific impact. It's not just that Haydn put that surprise in his famous symphony's slow movement -- it's that the surprise is a full-orchestral sforzando suddenly coming out of the most delicate background.

The 3BX-DS's adjustable impact-recovery circuit increases the immediacy, the sock, of all musical attacks. Many of these transients get clipped or otherwise dulled during recording and broadcasting because of the limiters that are in virtually universal use. The 3BX expansion recovers some of these losses, but it can't restore all the excitement.

With Impact Recovery -- especially when it can be somewhat tailored to suit the material as well as your taste -- we've tried to bring back a few of the heart-stopping qualities of live performance.

Naturally you will use Impact Recovery by ear. But let us suggest some starting points: try the first 1/3rd of the rotation for CDs of recent master tapes; the middle 1/3rd for LPs, most tapes, and high-quality FM, TV, and video; and the last 1/3rd for conventional FM, TV, and video, and tapes as needed.

#### Ambience

Some audiophiles have complained that many CDs sound hard and unspacious. And compared with LPs of the same tape, it's often true, because phono cartridges invariably add so-called out-of-phase (difference) information, which does increase spaciousness in the sound. While the CD may indeed be an unsurpassedly accurate copy of the master tape, we wouldn't like the shallow sound of it, either. Once again, your 3BX lets you you control the sound quality. On almost all recordings, the Ambience function will vary the depth and breadth of the sound stage.

For the technically minded, full-right rotation of the knob produces in the midrange 1.5L-0.5R in the left channel and 1.5R-0.5L in the right (proportions chosen through listening), with the -3-dB points of this added difference signal being at just under 200 Hz and at 6-7 kHz.

## WARRANTY and FACTORY SERVICE

All dbx products are covered by a limited warranty (warranties for products purchased outside the USA are valid only in the country of purchase and the USA). For details, consult your warranty/registration card or your dealer/distributor.

The dbx Customer Service Dept. will help you use your new product. For answers to questions and information beyond what's in this manual, write to:

dbx, Inc.  
71 Chapel St.  
Newton, Mass. 02195 USA  
Attn: Customer Service

You also may call (617) 964-3210 during business hours (USA Eastern time). The Telex is 92-2522.

Should problems arise, consult your dealer or distributor. If it becomes necessary to have your equipment serviced at the factory, repack the unit, including a note with a description of the problem and the date of purchase, and send the unit freight prepaid to the above address, notating it Attn: Repairs.

## FOR USERS IN THE UNITED KINGDOM

### Important

The wires in the unit's mains lead are coloured in accordance with the following code:

Blue: Neutral  
Brown: Live.

As the colours of the wires in the mains lead of this apparatus may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:

The blue wire must be connected to the terminal that is marked with the letter N or coloured black;

The brown wire must be connected to the terminal that is marked with the letter L or coloured red.

Ensure that all terminals are securely tightened and that there are no loose strands of wire.

### Warning

This unit must be protected by a 3-amp fuse, preferably using a fused plug.

Also, do not remove the cover without first disconnecting the unit from the mains supply.