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DBX DX3 COMPACT DISC PLAYER

Manufacturer's Specifications
Frequency Response: 10 Hz to 20 kHz, +0.5, −1.0 dB.
THD: Less than 0.002% at 1 kHz with signal processors switched out, 0.07% with processors switched in.
Dynamic Range: 96 dB without signal processing, 60 to 106 dB with processing.
Channel Separation: 90 dB.
Output Level: 2.0 V rms.
Dimensions: 17⅛ in. W × 3 11/16 in. H × 11 7/16 in. D (43.5 cm × 9.37 cm × 29.1 cm).
Weight: 10 lbs. (4.55 kg).
Price: $599.
Company Address: 71 Chapel St., Newton, Mass. 02195.
For literature, circle No. 92

If you're beginning to think that all CD players are pretty much alike, consider the DX3 from dbx, the company that developed linear companding, professional compressors and expanders, and a variety of other consumer and professional audio equipment. When dbx decided to enter the CD-player sweepstakes, it was only natural that they should add a little of their own brand of signal-processing magic to their first CD unit, and so they did. The designers decided that they should let the user "correct" some of the flaws they found in some CD software. Similar thinking is shown by Bob Carver, whose CD player offers a couple of nonadjustable "fixes" which must be used together or not at all. However, dbx offers four sonic embellishments, each of which can be varied in degree or intensity.

One of these embellishments, Digital Audio Impact Recovery ("DAIR"), is a form of fast-acting upward expansion which adds impact to musical transients. Why would anyone want even more dynamic range than is already available in

The DX3 can be made to compress signals, add dynamic impact, and widen or tighten the image. When not desired, those circuits can be switched out.

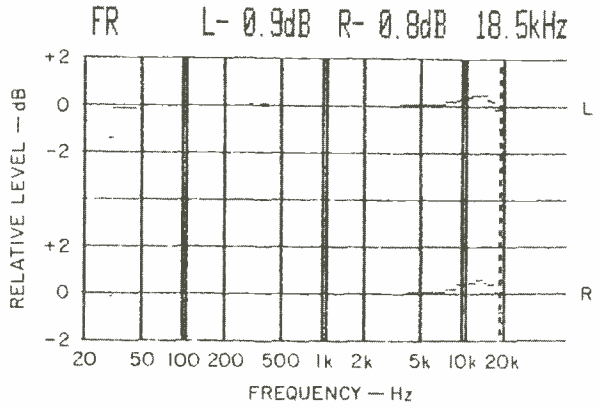

Fig. 1—Frequency response, left (top) and right channels.

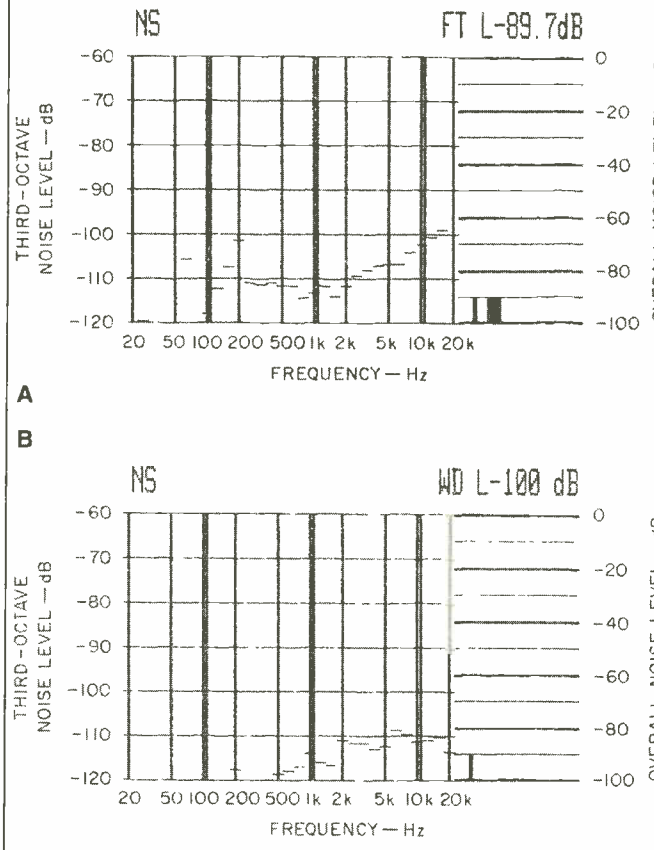

Fig. 2—Signal-to-noise analysis, unweighted (A) and A-weighted (B).

CDs? Well, dbx maintains that some CDs, such as those made from old analog masters, do not in fact offer as much dynamic range as they should, and DAIR is supposed to correct for those particular CDs' failings. The "Dynamics" knob which controls DAIR also controls a second embellishment, a variable amount of compression, when turned in the opposite direction. The purpose, here, is to reduce the dynamic range of CDs when listening to them as background music or when recording them onto cassettes to be used in your car. Anyone who has tried to play a digitally mastered, wide dynamic range CD in a car player will appreciate the ability to apply a bit of compression to such recordings, albeit via a cassette copy of the original CD.

A second control on the front panel of the DX3, labelled "Ambience," can be rotated clockwise to increase apparent separation or stereo spread. Turned in the opposite direction, the control has the reverse effect, decreasing separation until reproduced program material sounds almost monophonic. These two sonic tricks are nothing new. The apparent increase in separation is accomplished by adding a bit of out-of-phase left-channel signal to the right-channel output and a bit of out-of-phase right-channel signal to the left-channel output. (In the case of the DX3, the cross-blending of out-of-phase signals is done for middle and high frequencies only.) Conversely, simple in-phase cross-blending of middle and high frequencies reduces separation. As is true of the Carver CD player, the dbx DX3 has a switch which removes all of this special circuitry from the signal path. After all, there are some CDs that require neither compression, nor expansion, nor stereo enhancement, nor image "tightening."

As for the more usual CD-player features, the DX3 can be programmed to play up to nine selected tracks in any order. You can repeat an entire disc or the programmed tracks over and over again. Pairs of "Skip" and "Scan" buttons let you move quickly from track to track; if the latter are used while in play mode, you can audibly scan the program at an attenuated level to reach any desired point within a track quickly. Although indexed points within a track cannot be programmed or dialed in directly, any such points encoded on a CD can be displayed numerically during scanning, so you can stop the player when you reach the desired index point.

The display area shows either track number, elapsed time, or (in the stopped mode) total disc time, depending upon the setting of a pushbutton. Three rows of LEDs let you know how much and what type of signal processing is going on when either DAIR or compression is in use.

Aside from the controls already described, the DX3's front panel has the usual operating pushbuttons, such as "Open/Close" for the front-loading disc drawer, "Pause/Stop," "Play," "Repeat," "Program," "Display Mode" (for changing the display), and, at the extreme left of the panel, "Power." No remote control is provided. The usual output jacks are found at the rear of the player; there is no provision for controlling output level.

Measurements

Frequency response of the DX3, shown in Fig. 1, was essentially flat from 20 Hz to 20 kHz, with a slight rise at

Used with moderation, the compressor delivered a reasonable dynamic range, not too wide for recording nor so narrow as to destroy musical integrity.

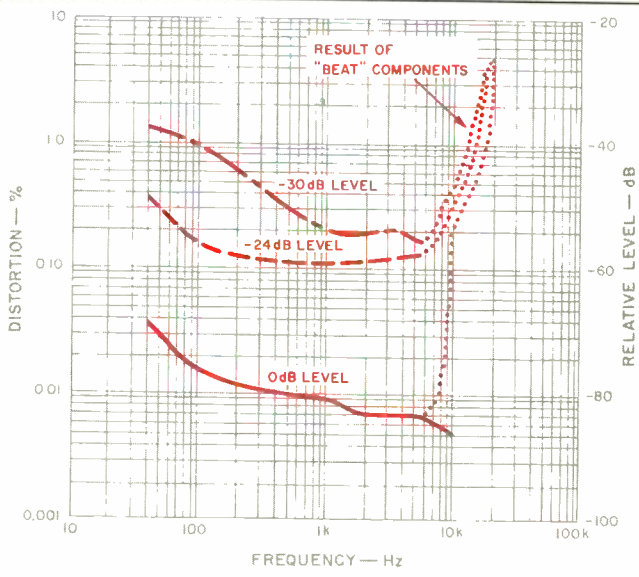

Fig. 3—THD vs. frequency at three signal levels.

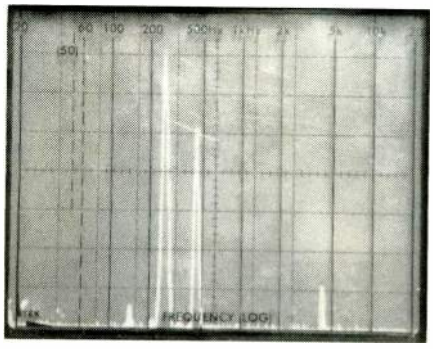

Fig. 4—Spectrum analysis of reproduced 20-kHz test signal, from 0 Hz to 50 kHz, showing out-of-band and in-band beats (see text).

about 15 kHz. At 20 kHz, response was down about 1.0 dB in each channel. Unweighted signal-to-noise ratio measured 89.7 dB, and the A-weighted measurement was a high 100.0 dB exactly. (See Figs. 2A and 2B.) The three curves of Fig. 3 depict harmonic distortion at maximum (0-dB) recorded level and at −24 and −30 dB levels. As is true of many CD players, harmonic distortion readings above 10 kHz are deceptive (and in fact rather meaningless), since many CD units tend to create "beats" between test discs' desired high-frequency signals and the sampling frequency (in this case 44.1 kHz). In Fig. 3 the sum of actual THD *plus* the spurious, out-of-band beats is depicted by the dotted-line plots at high frequencies. The effect of such beats is clearly illustrated in the spectrum analysis 'scope photo of Fig. 4. The analyzer was linearly swept from 0 Hz to 50 kHz. The tallest spike is the desired 20-kHz signal; the shorter one just to its right is an unwanted beat that is outside the audio frequency range. What surprised me about this test was the appearance of a much shorter spike or spurious component at around 16 kHz, well within the audible spectrum. This component may well have been a form of IM distortion caused by nonlinearities in the player's post-D/A analog output stages. When I reduced the output level by only 10 dB, it disappeared entirely, although the out-of-band beat remained at the same relative amplitude compared with the desired 20-kHz output. By introducing a band-pass filter (with a cutoff of 20 kHz), as suggested by the new EIAJ measurement standards, I was able to isolate the "real" harmonic distortion from these nonharmonically related components. Under those conditions, THD at 10 kHz measured only 0.005%, and at 1 kHz (even without the EIAJ filter) it measured an acceptably low 0.01% for 0-dB recorded outputs.

Amplitude linearity was not nearly as good as that which I have measured for most other CD players. While deviation from perfect linearity was only 1.1 dB at −60 dB levels, signals that should have theoretically been reproduced at −80 dB from my test disc were reproduced at a level of −68.4 dB. Of course, with the compression circuits active I would have expected this, but these results were obtained when the signal-processing circuits were completely bypassed. When maximum compression was applied, signals between maximum recorded level and −24 dB recorded level were squeezed into a dynamic range of no more than 2.5 dB, while signals recorded at −60 dB were raised to −30 dB at the output of the DX3. Of course, that's the most extreme case. Using somewhat less compression, the dynamic range was restored to a reasonable level—not too great to record onto cassettes without saturating tapes, but not so little as to destroy musical integrity.

SMPTE-IM measured 0.005% at maximum recorded level, increasing to 0.055% at −20 dB recorded level; CCIF-IM (twin-tone, using 19- and 20-kHz tones at the equivalent of highest recorded level) measured a low 0.011% at maximum recorded level and 0.035% at −10 dB recorded level.

Stereo separation, plotted as a function of frequency in Fig. 5, ranged from approximately 54 dB at the high-frequency extremes to no more than 65.0 dB at mid- and low frequencies, nowhere near the 90 dB claimed by dbx. Once again, these measurements were made with the signal-processing circuits turned off. I suspect that even with these circuits disabled, signals must pass through certain ICs which perhaps have an effect upon stereo separation. But, as I've often mentioned, I can't fault a CD player that provides more than 50 dB of separation throughout the audio band. Whatever the case may be with these ICs, many current CD players *do* do better than that, and I'm not sure why this one didn't. Of course, when the channel-blending circuit is introduced, separation drops down to next to nothing, but that's what is supposed to happen—reduction of the stereo spread. The unusual upper curve in Fig. 5 shows how mid-band separation is reduced to practi-

The nice thing about this player is that you can regulate the amount of blend or stereo spread with precision.

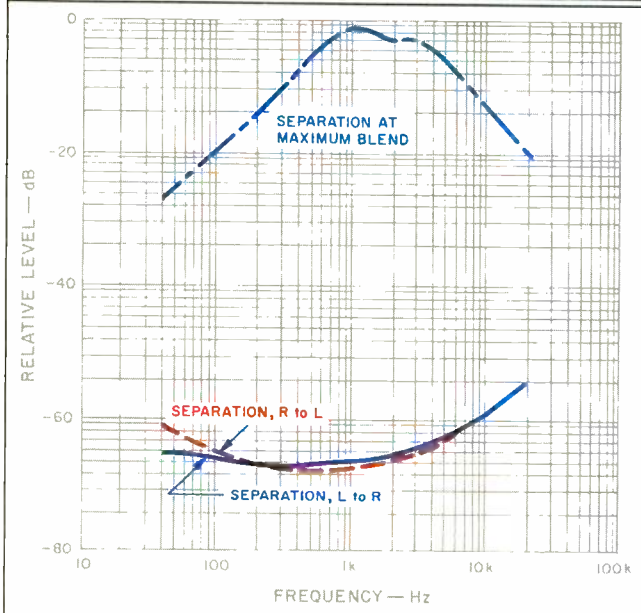

Fig. 5—Separation vs. frequency, without blend (bottom curves) and with maximum blend (top curve).

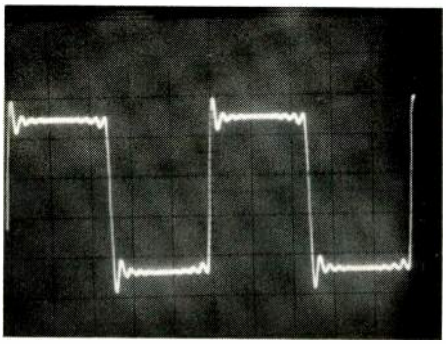

Fig. 6—Square-wave reproduction, 1 kHz.

cally nil (monophonic) when the "Ambience" control on the DX3 is turned fully counterclockwise.

Wow and flutter was too low to be measured by my test instruments. There was no measurable level difference between left- and right-channel outputs, both of which delivered exactly 1.9 V rms for maximum recorded level on a CD. Pitch error amounted to no more than 0.1%. Short access time (from one playing track to the next, using the track-advance keys) was no more than 1 S, and long access time (from an inner track to an outer track, using the programming mode) was close to 5 S.

Reproduction of a 1-kHz square wave is shown in the 'scope photo of Fig. 6. The reproduced wave shape is typical of that produced by CD players which employ steep digital filters and two-times oversampling. The unit pulse shown in Fig. 7 further confirms the use of digital filtering techniques. The owner's manual supplied with the DX3 advises that a third-order analog filter is used after D/A conversion to gently attenuate frequencies above 20 kHz. Such minimal filtering is enough to get rid of any 88.2-kHz components and sidebands of that frequency which result from the recovered program material. That, of course, is one of the benefits of oversampling; you don't have to use as steep a filter as you would if sampling were done at 44.1 kHz. Of interest, too, is the fact that dbx uses a three-spot or triple-beam laser pickup. It has yet to be definitively proven whether that arrangement is superior to the one-beam approach or vice versa.

Figure 8 shows the time difference between reproduced left- and right-channel 20-kHz signals; the 'scope's horizontal sweep calibration was set to 10 μS per division. This time difference amounted to just under 12 μS, indicating that a single D/A converter is being used in the DX3 rather than independent D/As for each channel.

The DX3 was able to play through the simulated scratch on my test disc, the 800-micron diameter simulated dust particles, and the simulated fingerprint smudge. Its resistance to vibration and shocks applied to its top surface was excellent as well.

Use and Listening Tests

Naturally, I was particularly interested in checking out the DX3's special signal-processing circuits. After I had satisfied myself that the player sounded good without any of those extra enhancements, I pushed the button marked "In," located near the two rotary controls that determine the amounts of signal processing. When I did that, the word "In" lit up just above the "In" button. I rather think someone might have come up with less redundant nomenclature, but no matter.

The "Dynamics" control, which offers either compression or impact recovery, earns a score of 50% from me. I don't own a single disc that can benefit from the DAIR half of the knob's rotation. In fact, if you want to know what "pumping and breathing" sounds like, turn that knob fully clockwise and listen to the player fairly gasping for air. On the other hand, I can see the merits of the compression half of the control. I've tried to record several of my favorite CDs onto cassettes; invariably, I end up with either a noisy background (because I held down record levels so as not to saturate the tape during peaks) or distorted musical crescendos. I wish dbx would come out with an accessory box so that those of us who have installed CD players in cars (or are planning to) could add such a compressor there.

(*Editor's Note*: I have exactly the reverse opinion of the DX3's DAIR circuitry and its effectiveness. Yes, I can easily hear it working, particularly when it's turned up to full effectiveness, but I don't turn it on unless I'm listening to an analog-based recording, usually of the pop/rock variety. On Rod Stewart's *Atlantic Crossing*, for example, the DAIR adds snap to the drummer's rimshots and punch to his kick drum. Similarly, there is more edge and penetration to the

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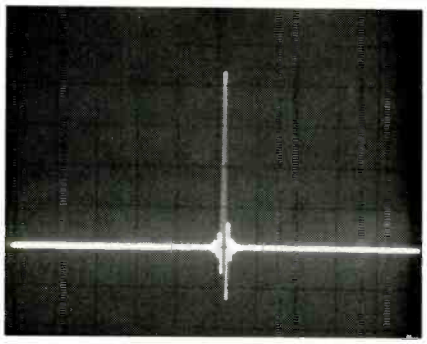

Fig. 7—Single-pulse test.

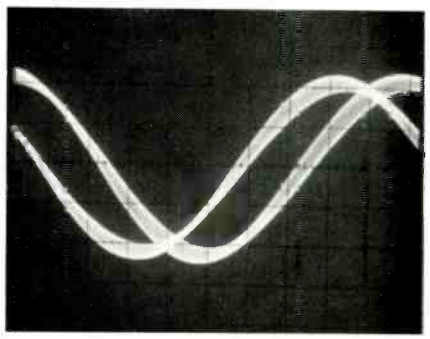

Fig. 8—Time difference between left- and right-channel 20-kHz signals.

guitar. Rarely do I add it to digitally recorded material, and I usually don't add very much of it.—*E.P.*)

As for the "Ambience" control, I feel much more kindly disposed towards *both* of its effects. I have CDs that do suffer from a lack of stereo spread or depth, and I also have some that exhibit exaggerated stereo effects. Both of these problems are the result of improper microphone placement, mix-down, or final mastering, and being able to selectively compensate for those instances of poor judgment on the part of recording engineers or producers is desirable. The trick of adding out-of-phase information from opposite-channel signals is an old one (I designed it into one of my first stereo preamplifiers back in the early 1960s), but it is very effective if used in moderation. Cross-blending, too, is an old trick for reducing exaggerated stereo spread (and, in FM, for reducing the extra noise generated during weak-signal stereo reception). The nice thing about the DX3 is that you can regulate the amount of blend or stereo spread with precision, thanks to the continuously variable "Ambience" control.

While I spent a good deal of time listening to the DX3's special circuits, I don't want to overemphasize them to you. Consider them an addition to the decently executed player underneath. In this light, the DX3 can be thought of as a good-sounding, moderately priced member of the third generation of CD players. *Leonard Feldman*