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HARMAN KARDON TD4800 CASSETTE DECK

Manufacturer's Specifications

Frequency Response: 20 Hz to 22 kHz, ± 3 dB, at -20 dB for all formulations; 20 Hz to 20 kHz, ± 3 dB, at 0 dB with Dolby C NR and metal tape.

Harmonic Distortion: 0.9% at 1 kHz at Dolby level with Type IV tape.

Signal/Noise Ratio: 66 dBA with Dolby B NR, 74 dBA with Dolby C NR, 75 dBA with Dolby S NR, all with Type II tape.

Separation: 45 dB.

Crosstalk: 70 dB.

Erase: 65 dB.

Bias Frequency: 210 kHz.

Input Sensitivity: Line, 45 mV.

Input Impedance: 22 kilohms.

Output Level: 1.15 V at 0 dB.

Headphone Impedance: 8 ohms minimum.

Flutter: 0.04% wtd. rms, $\pm 0.07\%$ wtd. peak.

Fast-Wind Time: 90 S for C-60 cassette.

Power Requirements: 120 V a.c., 60 Hz.

Dimensions: 17 $\frac{1}{8}$ in. W x 5 in. H x 12 $\frac{5}{8}$ in. D (44.3 cm x 12.6 cm x 32 cm).

Weight: 15.2 lbs. (6.9 kg).

Price: \$1,199.

Company Address: 240 Crossways Park West, Woodbury, N.Y. 11797 and 8400 Balboa Blvd., Northridge, Cal. 91239.

For literature, circle No. 91

The Harman Kardon TD4800 appears to be the first cassette deck with Dolby S noise reduction to reach actual production. This new noise-reduction system, described in the June 1990 issue, offers advantages over other designs, including Dolby C NR. Getting the maximum benefits from Dolby S NR requires high-quality recorder design, construction, and alignment. The TD4800 has three heads to ensure maximum magnetic performance and to permit monitoring the playback while recording. Its recording and playback circuitry uses discrete components for maximum design flexibility and highest possible performance. The Harman Kardon deck includes tape calibration with adjustable bias and record sensitivity. Front-panel metering of the adjustments aids in getting superior frequency response, low distortion, and optimum Dolby NR tracking. The TD4800

also has Dolby HX Pro to provide better high-frequency response at higher levels with all NR modes.

The deck's large fluorescent meter display simplifies setting record levels accurately. The elapsed-time counter keeps up with the tape in fast-winding modes and guides the user on efficient use of tape recording time. The monitor selector switches automatically so that the source signal is heard and metered when the deck is stopped, and the playback signal is heard and metered during recording and playback. However, the monitor's setting can be overridden manually. Intro scan and forward/reverse skip greatly speed up finding, identifying, and playing wanted selections. In "Replay" mode, the deck repeatedly rewinds and plays the current cassette side. A remote control is provided with the Harman Kardon TD4800.



In recording and playback, frequency response was excellent, with extended low and high limits.

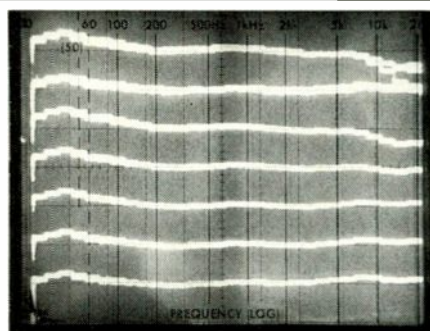


Fig. 1—Record/playback responses for band-limited pink noise, using Maxell XL-I tape. Top two traces show responses for all NR modes, superimposed; top trace is at Dolby level (meter zero), and second trace is at -20 dB. Bottom five traces are with Dolby S NR at (from third trace to bottom) 0, -5 , -10 , -15 , and -20 dB. See text. (Vertical scale: 5 dB/div.)

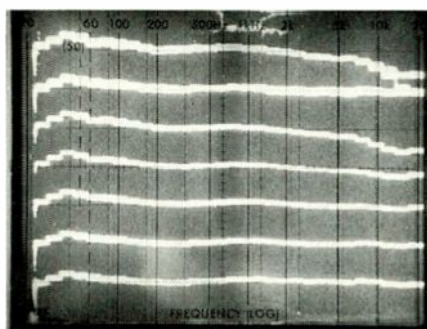


Fig. 2—Same as Fig. 1 but with TDK SA tape.

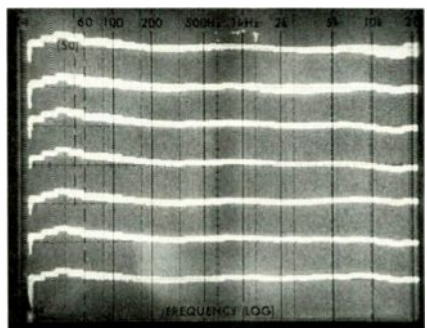


Fig. 3—Same as Fig. 1 but with TDK MA tape.

Control Layout

The TD4800 is somewhat larger than the typical deck, and a convex section near the top of the front panel reinforces this impression. At the left end is the large "Power" on/off button. Immediately to the right is the window of the cassette compartment door, which, along with the "Eject" button to its right, has the same curvature as the "Power" switch. The door opens smoothly after a gentle push of the button, providing easy access for loading and unloading tapes. The opening for cleaning and demagnetizing is good, and the front door cover can be removed for additional clearance. The dual-capstan drive and the tape guides appeared to be solidly built. The erase head and the sandwich-type, record and playback head structure are well supported.

To the right of "Eject" is the display panel, whose clear cover is curved to match the buttons flanking it. At the left is the sensor for the remote control, followed by the fluorescent elapsed-time display in "00:00" form. Next to the right are the fluorescent meters, with "L" above and "R" below. Each meter has 12 segments, blue-white from " -35 " to " -1 " and red from zero (double-D Dolby symbol) to " $+8$." The "dB" scale between the meters has the same color scheme, which aids in reading levels. Below these displays are a series of annunciators, all blue-white except for "Rec," which is red. From just below the left end of the counter, they are: "Memo," "Intro," "Replay," "Rec," "Play," double arrows for rewind (which flash during reverse skip) and fast forward (which flash during forward skip and intro scan), "Tape" and "Source," and "Type" (with indicators for "I," "II," and "IV") followed by the double-D Dolby symbol and "B," "C," and "S" to show which Dolby NR mode may be in use.

Below the left end of the display panel are horizontal-bar, spring-loaded buttons for "Bias Tone" and "Rec Cal." Some distance to the right are six similar buttons for "Dolby NR" ("Off," "B," "C," and "S"), "Meter Weighting," and "MPX Filter." Below these buttons are six good-sized transport control bars. From the left are record/pause, play, stop, rewind, fast forward, and record mute. When the deck is in record/pause or record mute, "Rec" flashes in the display panel, faster when muted than when paused. Below the record/pause bar is the "Bias Fine Trim" potentiometer, with "Hi Cut $-$ " at the left end of its scale and " $+ Hi Boost$ " at the right end. The left and right "Rec Cal" pots are centered under the transport buttons. The "Output" pot, which controls both line and headphone levels, is under "Rec Mute." All of the pots for "Rec Cal" and "Output" have "Min" at the left end and "Max" at the right. The bias and record calibration pots have helpful center detents, and these detents are soft enough for easy adjustment close to the center. When "Bias Tone" is held in, the left-channel meter shows playback level of a 400-Hz test tone and the right-channel meter displays playback level of a 12-kHz test tone. Bias level is adjusted to make the meter readings the same. When "Rec Cal" is pushed, a 400-Hz test tone is fed to both channels. Then, the pots for each channel are adjusted to make the two channel levels read meter zero.

At the top right of the front panel are seven large buttons, three above and four below, with the same convex shape as the display-panel window to their left. At the top left is "Intro

The MOL tests demonstrated the worth of Dolby S NR's distortion reduction and bass spectral skewing.

Fig. 4—Responses when using Dolby B and C NR to playback tapes recorded with Dolby S NR at (top to bottom) 0, -10, and -20 dB. Note the broad peak around 1 kHz, the rising high-frequency response for playback with Dolby C NR, and the falling high-frequency response for playback with Dolby B NR. (Vertical scale: 5 dB/div.)

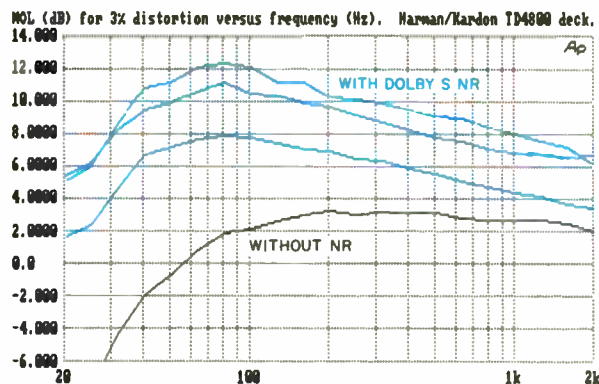
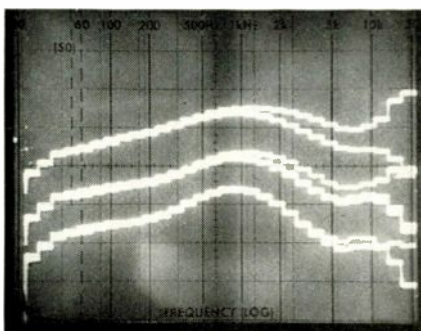


Fig. 5—MOL (for 3% distortion) vs. frequency from 20 Hz to 2 kHz. Top three curves were made with Dolby S NR with

(from top down) TDK MA, Maxell XL-I, and TDK SA tapes. Bottom curve is for TDK SA without noise reduction.

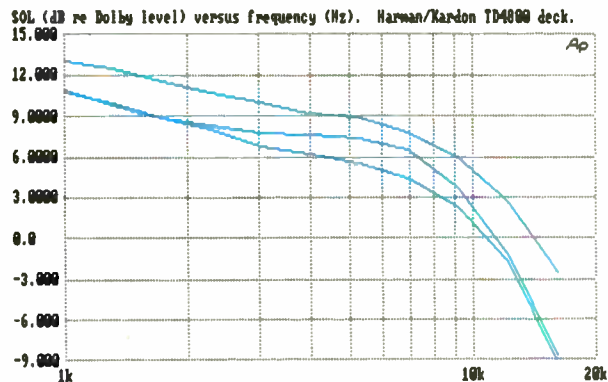


Fig. 6—SOL vs. frequency from 1 to 16 kHz, using Dolby S NR for (top to bottom) TDK MA, Maxell

XL-I, and TDK SA tapes, all referenced to Dolby level.

Scan," the largest of the buttons, for scanning the first 15 S of each selection on a tape. To the right are buttons for skip reverse and skip forward. When skip forward is used, "P 01" first appears in place of the normal counter display. If skip reverse is used, "P 00" appears (rewinding to the beginning of the current piece); a second push changes the display to "P-01." The maximum settings are "P 15" and "P-15," providing a fast wind up to 15 tunes from the current selection. Below those three buttons are "Monitor," "Reset" for the counter, "Memory" (which makes the tape stop at counter zero during rewind but not during fast forward), and "Replay." In "Replay" mode, the deck continuously rewinds the tape at its end and plays it back from its beginning, continuing until "Replay" is turned off (by pushing it again) or the stop button is pushed. Below these buttons are concentric "Input Level" pots. The knobs are large in diameter, making interchannel adjustments easy to make against their coupling friction. The "Headphones" jack is to the right. All panel labels are easy to read over a wide range of lighting because of their good size and the contrasting color.

At the left end of the rear panel are the stereo "Input" and "Output" phono jacks. Some distance to the right are the "Remote" jacks ("In" and "Out") that permit using an external infrared sensor and/or controlling other components through a connecting cable.

Examining the interior, I was immediately struck by the five large p.c. boards. The quality of the boards and the components was high, the layout was neat, and all parts were numbered. All visible solder joints were excellent. Connections between boards were made with ribbon cables or bundled single wires, all via multi-pin plugs and sockets. Support for the boards was good, and front-to-back rails and supports made the assembly rigid. I judged the transport design to be quite rigid, and the flywheels were fairly large in diameter. Operation was very quiet in record/play but was somewhat noisy while fast winding. The transformer was just warm to the touch after hours of use.

The remote control is light in weight and easily held in one hand. The first row of buttons from the transmitting end are "Display" at the left and counter "Reset" and "Memory" next to each other at the right. "Display" is an uncommon choice on a remote, but a good one it is: When the panel display is not needed, it can be turned off—reducing possible distractions and potential electrical noise. Some distance below are "Monitor" at the left and "Replay" and "Intro" scan at the right. Below are rows of buttons for rewind and fast forward, forward and reverse skip, record mute and record/pause, play, and stop. The light gold letters are very legible against the black background. The top of the control's back end is convex, repeating the motif of the deck's front panel.

Measurements

The TD4800's playback responses, using BASF alignment tapes, were very good with both 120- and 70- μ S equalization. All the points were within ± 0.5 dB from 31.5 Hz to beyond 10 kHz. The 15-kHz points were down about 2 dB. The indicated playback level of my Dolby-level test tape was 1 dB high, "+ 1" on the left meter and just at the "+ 1" threshold (flickering) on the right meter. Tape play speed was close, just 0.3% slow. The Maxell XL-I, TDK SA, and

Dolby S NR worked well with all but the very poorest and peakiest of the 90 tape formulations I used.

Table I—Record/playback responses (–3 dB limits).

Tape	With Dolby S NR				Without NR			
	Dolby Lvl		–20 dB		Dolby Lvl		–20 dB	
	Hz	kHz	Hz	kHz	Hz	kHz	Hz	kHz
Maxell XL-I	8.1	13.3	7.5	21.4	9.4	10.7	7.7	22.2
TDK SA	9.2	12.8	9.3	21.8	10.7	9.6	9.0	23.2
TDK MA	8.9	18.8	8.7	23.9	9.9	12.4	8.7	23.7

Tape	With Dolby C NR				Without NR			
	Dolby Lvl		–20 dB		Dolby Lvl		–20 dB	
	Hz	kHz	Hz	kHz	Hz	kHz	Hz	kHz
Maxell XL-I	9.4	12.9	7.0	21.5	9.4	10.7	7.7	22.2
TDK SA	10.9	12.2	8.8	21.7	10.7	9.6	9.0	23.2
TDK MA	9.7	20.9	8.6	23.7	9.9	12.4	8.7	23.7

Table II—Miscellaneous record/playback characteristics.

Erasure At 100 Hz	Separation At 1 kHz	Crosstalk At 1 kHz	10-kHz A/B Phase		MPX Filter At 19.00 kHz
			Error	Jitter	
71 dB	57 dB	< –90 dB	–7°	±2°	–38.1 dB

Table III—Signal/noise ratios with IEC A and CCIR/ARM weightings.

Tape	IEC A Wtd. (dBA)				CCIR/ARM (dB)			
	W/Dolby S NR		Without NR		W/Dolby S NR		Without NR	
	@ DL	HD=3%	@ DL	HD=3%	@ DL	HD=3%	@ DL	HD=3%
Maxell XL-I	70.7	79.0	52.5	58.3	71.7	80.0	49.3	55.1
TDK SA	73.7	79.6	55.3	58.3	74.5	80.4	52.5	55.5
TDK MA	74.1	83.5	55.8	62.4	75.0	84.4	53.0	59.6

Table IV—Input and output characteristics at 1 kHz.

Input	Level		Imp., Kilohms	Output	Level		Imp., Ohms	Clip (Re: Meter 0)
	Sens.	Overload			Open Ckt.	Loaded		
Line	37 mV	29.1 V	18.4	Line	950 mV	930 mV	351	+16.7 dB
				Hdphn.	980 mV	330 mV	102	

TDK MA tapes provided by Harman Kardon for evaluating the deck were used for the majority of the tests.

With the "Rec Cal" control at its center detent, the TDK SA cassette reproduced the calibration signal right at meter zero, but the record sensitivity adjustment could be varied from –3.2 to +4.1 dB to accommodate other tapes. The "Bias Fine Trim" oscillator frequency was 12.8 kHz, and the level change for SA tape during bias trimming was from –2.8 to +2.9 dB relative to the pot's center detent. There was very little bias in the playback output during recording, and the 200-kHz bias frequency was hard to pick out in a highly amplified oscilloscope display.

Figure 1 shows the record/playback responses with Maxell XL-I (Type I) tape, using a pink-noise source band-limited from 16 Hz to 25 kHz. The top trace, at Dolby level, includes the responses with Dolby B, C, and S NR and response without NR. All the responses are almost exactly the same up to 10 kHz. Above that frequency, the responses using Dolby C and S NR are further extended, but with Dolby B

and without NR, the roll-off becomes sharper. The second trace has the overlaid responses at –20 dB for the same four conditions; notice how closely the responses match at this level. The remaining five traces display the Dolby S NR responses from Dolby level to –20 dB, in 5-dB steps. Although all the curves have a moderate but unwanted response rise around 40 Hz, their consistent shapes prove the TD4800's excellent Dolby NR tracking.

Figure 2 provides the results for TDK SA tape under the same conditions as in Fig. 1. Compared to the results with XL-I, the 40-Hz rise is smaller but the high-frequency roll-off is greater (the latter expected with a Type II tape). Figure 3 shows the results using TDK MA (Type IV) tape for the same tests. The flatness of the responses at high frequencies at all levels is certainly impressive, although the moderate rise around 40 Hz remains a bit disappointing.

For all the response tests discussed above, I used pink noise as a source because sweeping or stepping sine waves can cause the true response deviations to be multiplied by Dolby noise-reduction systems. However, sine waves were used to obtain the results in Table I, which lists the –3 dB response limits for the three tapes when used with Dolby C NR, with Dolby S NR, and without noise reduction. The results are excellent, showing extended limits at both low and high frequencies. Table II lists several record/playback properties, all of which are excellent. The 71-dB erasure at 100 Hz with metal tape is one of the better results I have obtained to date, and the 10-kHz A/B phase results were the best to date.

Next, I recorded pink noise, using Dolby S NR, at meter zero and at –10 and –20 dB. I played the tape back using Dolby B and C NR and stored the responses on the oscilloscope. Figure 4 shows what happened: Both the Dolby B and Dolby C NR responses peaked around 1 kHz, and the responses with Dolby B NR roll off more than with Dolby C NR above this point. Above 10 kHz, the Dolby B responses roll off sharply while Dolby C NR responses are flat or rise noticeably. My scope was calibrated to show signals at meter zero three divisions down from the top of the screen. Thus, at 0 dB the Dolby B and C NR playback levels at 1 kHz are about 2 dB high. At –10 dB for Dolby S NR, the playback 1-kHz levels are about 7 dB high; at –20 dB for Dolby S NR, they are about 12 dB high. The playback response shapes with Dolby B and C NR are fairly consistent as level is changed, but compression is apparent in the figure. When I listened with headphones, the concentration of energy around 1 kHz was very obvious, and the rise above 10 kHz with Dolby C NR also stood out. As expected, a switch back to Dolby S NR in the –20 dB section of the tape caused an ear-catching level drop. My assessment of the sonic results when using other Dolby NR settings for tapes made with Dolby S NR awaited the in-use tests.

Figure 5 shows the TD4800's maximum output levels (MOLs) from 20 Hz to 2 kHz for the three tapes. The top three curves were made with Dolby S NR, and the rise in MOLs below 2 kHz is very obvious. The deck's MOLs for SA tape were plotted again, without Dolby NR, and the reductions in the 3% distortion limits were 6 dB at 90 Hz, 8 dB at 50 Hz, and 10 dB at 20 Hz. (The 20-Hz MOL without NR was –8.4 dB.) These results emphasize the distortion-reduction

Even using randomly chosen tapes, the excellent level matching and flatness with Dolby S NR impressed me.

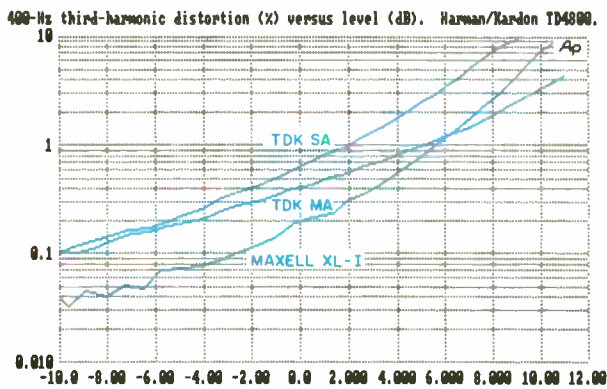


Fig. 7—Third-harmonic distortion vs. level for a 400-Hz signal, using Dolby S NR for the three tapes.

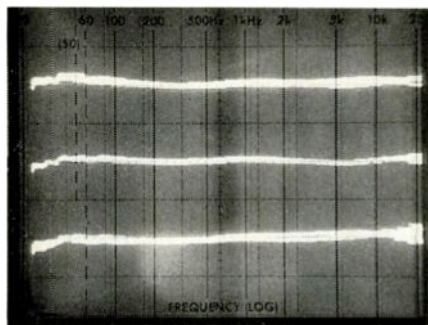


Fig. 8—Record/playback responses at -20 dB, using Dolby S NR, for five different formulations of each tape type. Top trace is superimposed response of Type I tapes, second trace is Type II tapes, and bottom trace is Type IV tapes. See text. (Vertical scale: 5 dB/div.)

capability of Dolby S NR and the advantage of its low-frequency spectral skewing.

The Harman Kardon's saturation output limits (SOLs) for the three tapes from 1 to 16 kHz when using Dolby S NR are seen in Fig. 6. The SOLs are highest using the Type IV tape, TDK MA, as expected. For XL-I and SA tapes, the SOLs are nearly as close at the frequency extremes, but XL-I is noticeably better between 2.5 and 10 kHz. With Dolby C NR, the SOLs would have been similar, but with Dolby B or no NR, they would have been noticeably less.

The 400-Hz third-harmonic distortion versus level for the three tapes is shown in Fig. 7. Dolby S NR helps to keep both noise and distortion low, although the distortion readings at the lowest levels include some noise. At -10 dB, the distortion for SA and MA tapes is the same (0.1%) but is much lower for XL-I tape (less than 0.04%). With increasing levels, distortion increases relatively slowly with MA tape and with XL-I it is higher than with MA above $+6$ dB.

I measured signal-to-noise ratios at Dolby level for the three tapes with Dolby S NR and without NR for both IEC A and CCIR/ARM weightings. Table III lists all these ratios plus those relative to the 400-Hz MOLs (3% third harmonic). The smaller difference in the ratios without noise reduction demonstrates the distortion-reduction characteristic of Dolby S NR. For example, without NR, the Maxell XL-I ratios are 52.5 dBA at Dolby level and 58.3 dBA at "HD = 3%," a difference of 5.8 dBA. With Dolby S NR, the results are 70.7 dBA at Dolby level and 79.0 dBA at "HD = 3%," a difference of 8.3 dBA.

At this point, I decided to try a wide range of tapes on the TD4800 using Dolby S NR. Although Harman Kardon had supplied selected tapes, I believed many formulations would be fine matches, especially with the TD4800's good record/tape calibration system. Using Dolby S NR, I tried most of the 90 tapes I have. The deck got at least very good responses from every tape except the poorest and those with peaked high-end responses. The following are but a few examples: Denon DX1 was not a good choice, but DX4 was an excellent one; Denon HD6 and HD7 were fine, HD8 was not; TDK AR and SA were excellent, AR-X and SA-X were not. Maxell's Metal Vertex and That's Type IV Suono both produced excellent responses on this deck. The impressive responses of BASF Metal IV pleasantly surprised me; I have had some trouble setting bias and record sensitivity for this formulation in the past—but not this time.

Figure 8 presents a series of -20 dB record/playback responses with Dolby S NR. Each trace is the result of overlaid responses stored one after another, five tapes for each tape type. I did not take the time to select the best five; I quickly picked out one tape after another, adjusted bias and record calibration, and then stored the response. The spread in the traces includes any response deviations and any level errors in the calibration. As I write this, I look at the oscilloscope photograph, and the excellent flatness and level matching impress me again.

Various input and output attributes at 1 kHz are shown in Table IV. The input sensitivity, 37 mV, is better (lower voltage) than that for most decks, and the output impedance is admirably low. The input impedance is slightly low, in my view, with the input pot wide open (test condition), but it increased with the control lowered to typical settings. The maximum output level was very high for all headphones I tried, but I easily controlled it with the output pot. The two sections of the input pot tracked within 1 dB from wide open down to 65 dB of attenuation, which is excellent performance. The sections of the output pot tracked within 1 dB from wide open down to 50 dB of attenuation, fairly good performance. The meter calibrations were very good over the entire range "from -35 " to " $+8$," and most actual thresholds were within 0.4 dB of the scale markings. Meter-segment and scale illumination was excellent. The meter response was 3 dB down at 17 Hz and at an unnecessarily high 236 kHz.

When using a 5-kHz tone burst with a continuous level 1 dB above meter zero and a 20-mS duration, I obtained a zero-level response. Any levels to zero or above caused a 2-S hold of the highest levels reached, which is good. Offset bursts yielded higher readings, as they should have. How-

The TD4800 is priced higher than some DAT decks, but it gets very high performance with low-cost, but not so lowly, analog cassettes.

ever, this effect was less pronounced with positive offsets than it was for negative offsets. With "Meter Weighting" pushed in, the higher frequencies (above 1 kHz) produced higher readings but not as much as record equalization would cause. With "Meter Weighting" actuated, I got a zero-level response from a 6-mS burst; this shows a faster meter response, which is good. The output polarity while recording was the same as the source with the monitor in "Source" but was reversed in "Tape."

Playback of a recorded 3-kHz tone showed no variation in tape speed when line voltage was reduced from 120 to 110 V. With the voltage increased to 130 V, the speed increased very slightly, by 0.01%. Over a few minutes, tape speed varied a maximum of $\pm 0.02\%$. Typical figures for flutter were 0.06% weighted rms and $\pm 0.08\%$ weighted peak, only very slightly higher than specification; after a couple of trials, I found cassettes that met the manufacturer's figures. Fast winding of one side of a C-60 cassette took 70 S; a C-90 took 103 S. From fast wind or play, the deck took 3 S to switch to stop mode when the tape ran out, and it took 1 S or less to reverse fast-wind directions or switch from fast-wind to play. When "Intro Scan" was actuated, the first 13 S of each tune on the cassette was played, which I found much more helpful than the 8 S many decks provide. The elapsed time shown by the counter for one side of a tape was 19 S high for a C-60, 80 S high for a C-75, and 50 S low for a C-90. Errors were of the same order of magnitude for C-100s and C-120s. Smaller errors are desirable, but the deck's tape-time calibration remains very closely the same whether in record (or play) or in fast wind—and that is very helpful. The remote control was effective out to at least 25 feet on the sensor's axis and could be pointed off 30° at that distance. At more normal distances, the control could be up to 60° off axis if it was pointed at the sensor and could be pointed off up to 45° if it was located on the sensor's axis.

Use and Listening Tests

The owner's manual is generally well written. Its illustrations are good, particularly the front-panel one that is almost full size. Several sections would benefit from more detail. The description of skip forward/reverse, for example, does not state that the maximum setting is "P 15" or "P-15." I also wished it said more on setting record levels, the effects of tape choices, and the reasons for selecting particular Dolby NR modes. In two places, the manual incorrectly states that record calibration adjustments are made "to match the playback sensitivity" of the tape. Such adjustments are made to match the tape's *record* sensitivity to the playback calibration of the Dolby decoder.

I checked for noises recorded when switching to record, pause, or stop, using Dolby C NR and amplifying the playback greatly for aural and meter monitoring. Record and pause sounds were soft, double clunks which were slightly above the level of tape noise on the deck's meter. Stopping produced a triple clunk which was a bit louder, reaching about 2 dB above the tape noise. Pushing "Rec Mute" produces a 5-S muting and then a switch to record/pause. A shorter mute was easily secured by pushing the record/pause control. A longer mute was obtained by holding in "Rec Mute"; the deck went into record/pause as soon as the

button was released. During muting, the red "Rec" annunciator flashed more rapidly than during record/pause.

All the controls and switches were completely reliable throughout the evaluation. I did find, however, that if I simultaneously pushed the play and record/pause buttons to begin recording, I might get just play instead. Therefore, I pushed the play button *after* pushing and releasing record/pause. Because of the buttons' small size, dark color, and lack of annunciators, I had to look carefully to tell if "Meter Weighting" and "MPX Filter" were on.

My first listening evaluation was from two sample Dolby S NR cassettes supplied by Dolby Laboratories—Eric Clapton's *Journeyman* (Reprise Records) and Joe Sample's *Spellbound* (Warner Bros.). Both sounded very good to me using Dolby S NR for the playback. Even listening at high volume through headphones, I still heard very little intertrack noise. When I switched back and forth from Dolby S to Dolby B or C NR, the emphasis in the middle frequencies was obvious and the level compression became apparent. The sonic character was generally consistent, and I judged that most listeners would accept, but not prefer, playback of Dolby S-encoded tapes with Dolby B or C NR.

I used a pink-noise source for my first record/playback tests with the three supplied cassettes. The TD4800's bias and level calibration system worked very well, and the sonic matches were excellent for the three tapes and for all NR choices. The first CD I tried was *Music of Waldteufel* (MMG MCD 10025; now available as Vox Unique VU 9009) performed by the Cincinnati Pops Orchestra with Erich Kunzel conducting. The advantage of Dolby S NR for low-frequency material was most apparent during bass drum beats, which were frequent on some of the pieces. Reproduction of cymbal crashes was best with Dolby C or S NR. On *Bach: The Organs at First Congregational Church, Los Angeles* with Michael Murray (Telarc CD-80088), I tried very high levels during low pedal notes with Dolby S NR. I was quite impressed with how Dolby S NR decreased distortion and reduced compression, keeping the distortion low at relatively high levels. Tchaikovsky's "1812" Overture (Telarc CD-80041), performed by Kunzel and the Cincinnati Symphony Orchestra, proved to me again how much low-frequency energy the cannon shots contain. Dolby S NR made normal recording levels possible; levels had to be reduced considerably with any other NR choices. I tried other CDs, and the TD4800 secured excellent reproduction from all of them; the tape/source match was outstanding in all cases.

The TD4800's metering was very good for setting levels quickly and accurately. Personally, I did not find an advantage to "Meter Weighting," but it might help some users avoid tape saturation. The flat responses, the bias and level calibration system, Dolby S NR, and the low distortion and noise were my major satisfactions. I also particularly liked the elapsed-time counter, the good displays, intro scan, and the skip function. It might be nice to have some other convenience features, but I didn't miss them. The price of the TD4800 is high—higher, in fact, than that of some DAT decks. However, this cassette deck is worthy of comparison to any other cassette deck at any price, and its very high performance can be obtained with low-cost software, the not-so-lowly cassette.

Howard A. Roberson