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## KENWOOD KX-660HX CASSETTE DECK

### Manufacturer's Specifications

**Frequency Response:** 20 Hz to 16 kHz with Type I tape; to 17 kHz with Type II tape, to 18 kHz with Type IV tape.

**Harmonic Distortion:** 0.9% at 0 VU.

**Signal/Noise Ratio:** 67 dB with Dolby B NR, 74 dB with Dolby C NR.

**Input Sensitivity:** Line, 77.5 mV; mike, 0.35 mV.

**Output Level:** Line, 0.35 V; head-phone, 0.3 mW.

**Flutter:** 0.06% wtd. rms,  $\pm 0.16\%$  wtd. peak.

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

**Dimensions:** 17<sup>5</sup>/<sub>16</sub> in. W x 4<sup>7</sup>/<sub>16</sub> in. H x 12<sup>13</sup>/<sub>16</sub> in. D (44 cm x 11.3 cm x 32.6 cm).

**Weight:** 11.1 lbs. (5 kg).

**Price:** \$300.

**Company Address:** 2201 East Dominguez St., Long Beach, Cal. 90810.

For literature, circle No. 92



The Kenwood KX-660HX cassette deck provides a number of interesting, useful features for a moderate price. Record/playback performance is improved by the inclusion of Dolby HX Pro, which matches the bias to the spectral content of the music. The KX-660HX also has a bias-trim control to improve tape-to-deck matching for a wide variety of tapes. Both Dolby B and C NR are included, and there is automatic tape-type sensing to set EQ and nominal bias.

The Kenwood deck offers a number of play-mode conveniences in what it calls its Direct Program Search System (DPSS). These include fast winding to a selected tune, repeat playback, index scan, and other choices, all of which will be discussed more fully later. The counter, which nor-

mally shows elapsed time in minutes and seconds from wherever it was reset to zero, also provides a readout of information for various modes of DPSS operation. This counter is not a mere clock that times recording and play, but has the more important feature of updating time readings even while fast winding. Recordists can benefit from the "Blank Search" function, which finds a blank section of tape if it is at least 1 minute long, measures its length in time, rewinds back to the beginning of the blank portion, and changes the counter display to indicate the recording time remaining on that blank segment. Other interesting features include peak-responding meters, microphone inputs, and a master level control with two channel-level pots.

## Control Layout

At the left end of the front panel are the eject button (top) and the power on/off switch (bottom). With their different shapes and the latter's good-sized "Power" label, these pushbuttons will likely not be confused, as is possible on many decks. The cassette compartment door opens wide for easy tape loading and removal. Access for cleaning and demagnetizing is good with the door open, but it makes sense to slide the door/cover completely off, for then access is excellent.

To the right of the cassette compartment are three small display panels. From left to right, they are labelled "DPSS/Linear Tape Counter," "Operating Ind.," and "Auto Tape Sel." The DPSS and counter numbers are bluish white, which makes for easy reading. The DPSS numbers indicate how many tracks (up to 16) the deck has been instructed to fast wind through (in either direction) before switching to playback, as well as the countdown to the desired selection. This area also shows the number of repeats when the deck is in its repeat-play mode. The tape-counter readout shows elapsed time in minutes and seconds from the point of reset, unless "Blank Search" is used, in which case the readout is in remaining time. The "Operating Ind." panel has a small yellow-green indicator for "Play" and a small red one for "Rec." "Auto Tape Sel." has red LEDs for "Norm," "CrO<sub>2</sub>," and "Metal."

To the right of the display area is the "Index Scan" pushbutton, and below it the "Blank Search" button. (These functions will be discussed later, in conjunction with the transport switches.) Below the display panels, from left to right, are the "Counter Reset" button and two slide switches, one for "Timer" ("Rec/Off/Play") and the other for "Dolby NR" ("B/Off/C").

Below these switches are the large, light-touch transport-control pushbuttons. In the upper row are buttons for rewind, play, and fast forward, with "Rec/ARM Pause" to their right. A large, horizontal stop bar is below the other three motion-control switches, and "Pause" is to its right. Record mode is secured with a single push of "Rec/ARM Pause." If this button is pushed during recording, Automatic Record Mute takes over, muting the signal and flashing the "Rec" LED for 4 S, after which the deck stops in record/pause mode and the "Play" LED flashes. Holding in "Rec/ARM Pause" prolongs the muting; pressing it again before 4 S elapse removes the mute and continues the recording. A push of regular "Pause" during the 4-S muting period stops the recorder in record/pause at that point; resumption of recording then requires a push of "Rec/ARM Pause." If "Pause" is used when in play mode, the "Play" indicator on the display will flash; resumption of playback then requires a push of the play button. If the play button is pushed in record/pause, the deck drops out of record mode into play. There are good features here, but the user does have to keep the protocol in mind.

The transport switches are also used in various ways to activate the DPSS functions. The deck can be instructed to find and play a cut up to 16 selections away from the tape's current position; one simply taps the fast-forward or rewind button the appropriate number of times while the deck is in play mode. During this operation, as mentioned earlier, the

counter readout keeps track of the input number (the number of selections to be skipped) and counts down as the desired selection is neared. Repeating a selection 16 times is a simple matter of pushing the play button twice while in stop mode, or once if the deck is already in play. The repeating can be terminated with a push of the stop bar.

Pushing both fast-wind buttons at the same time gets what Kenwood calls "Dash & Play" operation. In this mode, the entire side of a tape can be repeated 16 times, and the deck will fast forward past any blank sections of more than 16 S. A simultaneous push of the rewind and play buttons gets a rewind to the beginning of the tape, with play beginning at the first selection. If "Index Scan" is pushed, the tape advances rapidly to the beginning of each selection in turn and plays back the first 10 S of each. When a desired tune is reached, pushing the play key returns the deck to normal operation.

If there is a blank section of at least 4 S before the start of a recorded passage, a push of rewind while in record mode will get an automatic rewind to the start of that passage and then a switch into record/pause—making it easy to re-record. The KX-660HX also has a feature called "Zero Stop," which amounts to what other makers call memory stop: If the stop key is pushed at the same time as the fast-forward or rewind key, the transport will stop when the time display shows ":00."

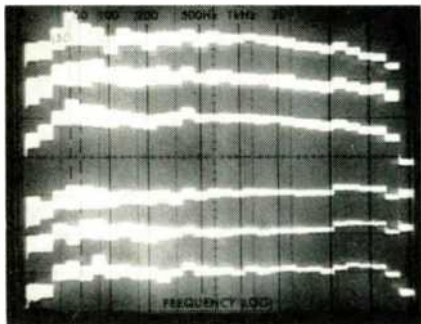
"Blank Search" accomplishes quite a bit with the push of a button. The deck goes into fast forward to find a blank section of tape at least 1 minute long, measures the normal-speed record time of the blank section while still in fast wind, resets the counter at the end of the section to -10 S (99:50), rewinds the tape to the beginning of the blank portion, goes into record/mute for 4 S, and then switches to record/pause. At this point, the counter shows the time available for recording, and as you record, it counts down to show remaining time. It might take the KX-660HX a little while to measure the length of the blank portion of tape, but it's faster than the user doing the same thing—and the procedure brings the welcome gift of a remaining-time counter. I consider this one of the best features in any moderately priced deck.

To continue with the front panel: Just to the right of "Pause" is the valuable bias adjustment pot with a center detent and a small bar knob. To its right are the fluorescent peak-responding level meters for the two channels; these run vertically and are easy to read. To their right are the left and right "Preset" level controls, and at the far right is the "Master Rec Level" pot. The labelling helps to get across the idea that one should use the channel-level controls for basic level setting and balancing and the master control for fading both channels in and out. This is a desirable level-control arrangement, and relatively few decks have it. Below these pots at the panel's far right are the left and right microphone jacks and the headphone jack.

All of the front-panel labels are white; on the black of the panel, they are very easy to read, even in relatively low lighting.

The back panel is very simple, with just the stereo in/out phono jacks and the power cord. I removed the top and side cover to get a look at the internal construction. The

Worthy of applause are the responses at  $-20$  dB, which were very flat for all three tape types over nearly the entire band.



**Fig. 1—Record/playback responses with Dolby C NR for "PN/Music" signal. Top three traces show response for signals recorded at an rms level equivalent to Dolby level, using (top to bottom) Maxell XL I, Denon HD8, and SKC ZX. Bottom three traces are for  $-20$  dB recording level using the same tapes. (Vertical scale: 5 dB/div.)**

main p.c. board is about half-chassis size, fairly well supported but slightly springy. Two small vertical boards are plugged into it, one for Dolby NR circuitry and the other for bias. There is also a fair-sized vertical board just behind the front panel, which holds the controls and displays. The few adjustments are labelled by function. The majority of the parts are identified, and the ICs are soldered in place. Soldering was very good at all points that could be seen. Interconnections are made with multi-pin plugs and sockets, sometimes with ribbon cabling and sometimes with individual wires. I did not spot any fuses, but one resistor looked as though it might function as a fuse. The transformer is mounted at an angle, a good distance from the p.c. board, and it was just warm after a long period of use. The two-motor transport was very quiet in all modes. One motor is used only for driving the capstan, and the other one is for the tape-drive hubs and the cams used for shifting the tape heads. A small solenoid is also part of this design. The bottom chassis plate is folded up at the sides to create side rails, which makes the assembly quite rigid. The back panel flexed rather easily but was well restrained with the cover on and the two back screws in place.

### Measurements

Playback response using TDK (120- $\mu$ S) and BASF (70- $\mu$ S) alignment tapes was very good overall. A little high-frequency roll-off occurred with each tape, but most of the points for both channels were within 0.7 dB of the Standard for both equalizations. Dolby play-level indications were right at the meters' double-D Dolby symbol. Tape play speed was 1.1% fast.

Record/playback response was checked using "PN/Music," which is pink noise whose response is shaped to make it more music-like: The signal's extremes are rolled off sharply, and there is a shelf at about  $-8$  dB from 5 to 16 kHz. The pink noise is flat on a  $1/3$ -octave basis from 25 Hz to

1.6 kHz, with a downward transition from 2 to 5 kHz. The playback from the deck is given compensating equalization so that a flat record/playback response will produce a flat display on my real-time analyzer.

Many tapes were tried with the Kenwood deck, and the great majority of them provided good response when the bias adjustment was made carefully. The owner's manual for the KX-660HX has a page showing bias requirements for more than 30 tapes, and the settings that gave me the best results were fairly close to the suggestions in the manual. In supplying this information, Kenwood has provided a very helpful—and all too uncommon—service to the user.

Among Type I tapes, the best responses were obtained with BASF LH Maxima I, Denon DX3, Maxell XL I, Memorex MRX I, SKC AX, TDK D, and Triad F-X. Among Type II tapes, Denon HD8, Memorex HBX II and CDX II, Sony UX-ES, TDK SA, and Triad EM-X gave the best results. Nakamichi ZX, SKC ZX, and TDK MA-X stood out above the other metal-particle tapes. I selected Maxell XL I, Denon HD8, and SKC ZX for the detailed tests to follow because they worked somewhat better than others of the same type, with TDK D and Memorex CDX II very close behind.

Figure 1 shows record/playback responses using Dolby C NR, with PN/Music at an overall rms voltage level to match the 400-Hz Dolby level (200 nWb/m) and at 20 dB lower. The peak-responding meter indications for these two levels were "+8" and "-10," respectively. At the higher level, a gentle roll-off starts at about 1.6 kHz and is down by 1.5 to 2.0 dB at 10 kHz. More worthy of applause are the responses at  $-20$  dB; they are very flat for all three tapes over nearly the entire band. The sine-wave record/playback responses are listed in Table I, and from the results one can see the benefits of Dolby C NR in extending response at higher levels. The possible benefits of HX Pro were not clear in this regard. The multiplex filter was in at all times, leading to a very sharp roll-off above the limits listed for recording at  $-20$  dB.

Table II presents a number of record/playback characteristics. Although the 10-kHz phase figures are not impressive, the other results are excellent. Crosstalk was far down in the noise, much more than 90 dB below the recorded 1-kHz tone. The 64-dB erasure of Type IV tape at 100 Hz is better than what many other decks accomplish, and the separation and the multiplex notching are similarly superior.

Third-harmonic distortion was measured at 400 Hz for the three tapes. This test was conducted using Dolby C NR from 10 dB below Dolby level (200 nWb/m) up to the point where the HDL<sub>3</sub> reached 3%. Table III shows that the lowest distortion at  $-10$  dB was achieved with Denon HD8 but that Maxell XL I had the highest 3% limit. The HDL<sub>3</sub> was also measured from 50 Hz to 5 kHz at  $-10$  dB with Denon HD8. The results, shown in Table IV, are very good, with moderate rises in distortion at the frequency extremes. The good performance at the high-frequency end is judged to be a benefit from this deck's HX Pro circuitry.

S/N ratios for the three tapes, with and without Dolby C NR, were obtained with dBA and CCIR/ARM weightings at Dolby level and at the 3% distortion point. Results are shown in Table V. Denon HD8 had the best ratios, though the figures for all three tapes are certainly very good.



All scale calibrations were accurate to within 0.6 dB, and most of them were within 0.3 dB, which is very good.

Various input and output properties are listed in Table VI. All of the results are close to specification, and that is good, but I would prefer a higher output level. The headphone output delivered 0.34 mW to an 8-ohm load, a helpful bit higher than the specified 0.3 mW. There was a good, high level on all of the several headphones tried. The two sections of the "Master Rec Level" pot tracked within 1 dB from 0 to 55 dB of attenuation, which is excellent performance. In record mode, the output polarity was the same as that of the source, but it was reversed in tape playback.

The level meters were 3 dB down at 30 Hz and 19.8 kHz. Meter zero was 2 dB below Dolby level. Tone-burst tests showed that the meters were truly peak-responding: Not only did they reach zero in 10 mS, but the indications were at least somewhat higher—as they should be—if the burst had a plus or minus d.c. offset. The decay time was only 0.58 S, definitely on the short side compared to the IEC Standard 1.7 S. The vertical meter display has 13 segments for each channel. The segment at the bottom (for minus infinity) is illuminated whenever the deck is on. The color of this segment and of those from "-20" to "-2" is bluish-white, and from "0" to "+12" it is orange-red. All of the scale calibrations were accurate to within 0.6 dB, and most were within 0.3 dB, which is very good.

Tape play speed was substantially constant regardless of the line voltage. Play speed dropped slowly from the beginning of a C-90 cassette, about 0.04% over the 2-minute check time. Flutter was quite good and very consistent over the length of a C-90: It was 0.055% wtd. rms and  $\pm 0.075\%$  wtd. peak. Fast-wind times were rather slow, 89 S for a C-60 and 124 S for a C-90. Run-out to stop in fast-wind or play took about 2 S. Changes in fast-wind direction took about 1 S, as did going from fast wind to play. Punch-in recording (going to record mode while in play) is not possible with the KX-660HX, but this feature is not common even on more expensive decks.

### Use and Listening Tests

The owner's manual uses illustrations well to guide the user, and the call-outs which explain the controls and their locations are more helpful than usual. The manual includes good general statements on setting record levels, although more detail would be of value. The instructions for the Direct Program Search System are generally well done, with good illustrations accompanying them. The language describing one DPSS mode is ambiguous, suggesting that up to 16 different selections can be chosen for play in any order when, in fact, fast winding and then play is possible for a single selection up to 16 tunes away from the current one. The other six DPSS modes ("One-Tune Repeat," "Index Scan," "Dash & Play," "Rewind Play," "Blank Search," and "Re-record Standby") are also nice to have, and their instructions are clear. I do want to comment again that Kenwood provides a valuable service to the user by listing the bias requirements for a number of tapes.

All of the controls and switches were completely reliable throughout the testing. When I first started using the deck, I did not have an owner's manual and found some of the deck's reactions to the transport switches to be unexpected. With the aid of the manual and a little practice, I was

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

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	13.3	10.2	12.4	16.9	13.3	9.6	12.5	17.8
Denon HD8	13.2	11.3	11.4	17.1	13.2	10.5	11.5	17.9
SKC ZX	13.3	11.8	12.7	17.0	13.3	10.8	12.9	17.8

Table II—Miscellaneous record playback characteristics with Type IV tape and Dolby C NR.

Erasure At 100 Hz	Sep. At 1 kHz	Crosstalk At 1 kHz	10-kHz A B Phase Error	Jitter	MPX Filter At 19.00 kHz
64 dB	63 dB	< -90 dB	-15	30	-40.0 dB

Table III—400-Hz HDL<sub>3</sub> (%) vs. output level (0 dB = 200 nWb/m).

Tape	NR	Output Level					HDL <sub>3</sub> = 3%
		-10	-8	-4	0	+4	
Maxell XL I	Dolby C	0.15	0.16	0.32	0.40	1.0	+6.6 dB
Denon HD8	Dolby C	0.05	0.11	0.22	0.63	2.0	+4.9 dB
SKC ZX	Dolby C	0.11	0.18	0.36	0.84	2.2	+4.5 dB

Table IV—HDL<sub>3</sub> (%) vs. frequency using Dolby C NR.

Tape	Level	Frequency (Hz)						
		50	100	400	1k	2k	4k	5k
Denon HD8	-10 dB	0.20	0.20	0.05	0.10	0.10	0.09	0.13

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

Tape	IEC A Wtd. (dBA)				CCIR ARM (dB)			
	W/Dolby C NR		Without NR		W/Dolby C NR		Without NR	
	( $\alpha$ DL)	HD=3%	( $\alpha$ DL)	HD=3%	( $\alpha$ DL)	HD=3%	( $\alpha$ DL)	HD=3%
Maxell XL I	69.5	76.1	52.5	59.1	70.4	77.0	49.9	56.5
Denon HD8	72.9	77.8	57.0	61.9	73.9	78.8	54.5	59.4
SKC ZX	72.8	77.3	56.7	61.2	73.4	77.9	54.1	58.6

Table VI—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	71 mV	>30 V	51	Line	325 mV	280 mV	1,960	+18.4 dB
Mike	0.33 mV	29 mV		Hdphn.	210 mV	132 mV	29.5	

For its moderate price, the Kenwood performs very well in most respects, and its many features offer real benefits.

able to take advantage of the many record/play functions that this Kenwood deck offers. "Zero Stop" was used frequently, and I benefited from "Index Scan." My personal favorite was "Blank Search," with its determination of recording time available and its remaining-time counter.

When the deck went into record, pause, or stop modes, all sounds were very low, both by ear and by meter. Setting record levels with music was easier than I anticipated, although a longer meter decay time would have been helpful. The meter display was very easy to observe, and setting levels was quite easy with the two channel pots and the master control. My first recording/listening checks with the Type I Maxell XL I were a little puzzling at first; then I realized that I hadn't set bias trim for the best results. This emphasized that such adjustments can make a very noticeable difference.

CDs were used as the sources and references for all listening tests. Tape playback even with Dolby C NR could not match the CDs in terms of low noise, and close listening during quiet passages always revealed that. Bach's "Brandenburg Concerto No. 5," performed by I Musici (Philips 412790-2), is a favorite of mine, and I really enjoyed the playback of a copy made on Maxell XL I when I got the bias trimmed correctly. There was a slight tightness in the violin tone, however, and an obscuring of details in comparison to the source.

*Chronicle* by Creedence Clearwater Revival (Fantasy FCD-623-CCR-2), copied onto Denon HD8, benefited from having the record level reduced a couple of dB from where I first set it. The sound was really quite good, but I perceived an obvious lack in the tape's lowest bass compared to the Compact Disc.

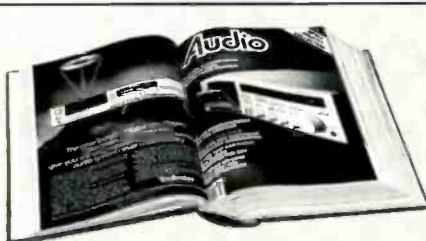
I used the SKC ZX tape to record music of Debussy ("La Mer" and other works) performed by the Saint Louis Symphony Orchestra with Leonard Slatkin conducting (Telarc CD-80071). The playback was quite good, but I kept thinking that I ought to be able to hear more of the subtle detail in some of this music. I tried reducing bias, but that did not improve the results. There was also some loss of the deepest bass—perhaps slight, but somehow obvious once it was noticed.

The playback of the KX-660HX cannot match a CD and it cannot be pushed to high record levels if the music has considerable high-frequency energy. For a moderately priced deck, however, the Kenwood performs very well in most respects, delivering flat response except at high levels, low flutter, low noise, and good distortion characteristics. The many convenience features require a bit of a learning period, but the benefits are real for those who can take advantage of them. The KX-660HX is definitely worthy of comparison to other decks in the same and somewhat higher price ranges.

Howard A. Roberson

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