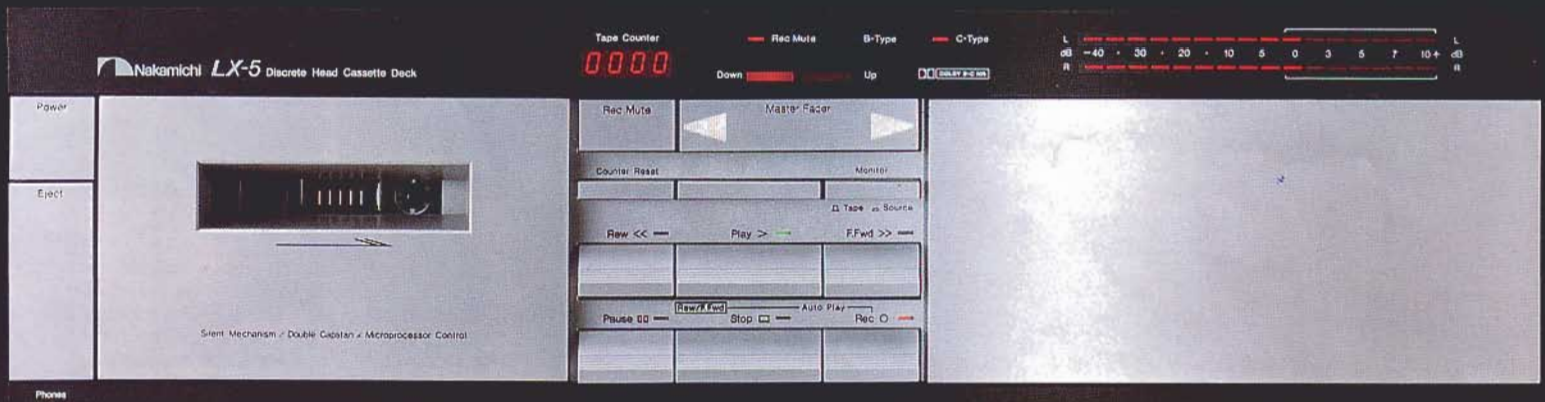
Nakamichi
LX-5/LX-3
Discrete Head Cassette Deck
2-Head Cassette Deck



Simplified Operation/Superior Display

A New Microprocessor-Controlled Tape Transport, Automatic Master Fader, And LED Display Simplifies Operation And Provides Some Unusual Features.

Simplified Operation

Even the music lover unaccustomed to audio tape decks will find it remarkably easy to produce extraordinarily recordings on the LX-5 and LX-3 thanks to the sophistication that lies hidden within. Microprocessor control virtually eliminates the possibility of tape damage even if you press the wrong button, and a special feature creates professional fades to and from full recording level at the touch of a bar!

Microprocessor-Controlled Transport

An advanced 4-bit N-MOS microprocessor monitors the "silent mechanism" transport, control panel and (optional) remote-control unit, senses your every command, interprets it, inserts intermediate commands if they are necessary to prevent tape damage, and instructs the drive on how best to carry out your wishes. A light touch on any operation button is all that is required on your part, and it is virtually impossible to make a mistake! The microprocessor also makes possible such added features as Auto Playback, and, on the LX-5, Punch-In Recording.

- Auto Playback .... Want to repeat a favorite selection or advance to another? Just press REW (or F. FWD) along with RECORD to engage Auto Playback. The transport rapidly winds the tape until the counter reads "0000" and automatically begins to play from that point. To mark the point to which you want to return, just tap the tape counter reset button.
- Punch-In Recording (LX-5) .... To do "tight" editing — say, to insert a narration between selections — you can switch directly from the playback to the recording mode without stopping the tape. Just press RECORD and PLAY together.

Mechanism-Control Microprocessor

Master Fader Control

Once channel balance and maximum recording level are adjusted, you can create smooth fades up to full level and down to silence by pressing the right or left side of the Master Fader bar. A single tap initiates a 6-second fade; press and hold the bar and you create a 2-second fade-automatically!

Bias Fine Tuning

Optimum bias often differs slightly among the various brands of tape even among those that are nominally of the same "type." Since bias affects recording Characteristics (especially at high frequencies) and thus might prevent the very best performance, the LX-5 and LX-3 have a Bias Fine Tuning control to achieve optimum response with each tape. The control is set so that the playback sound matches the original as closely as possible. This is very easy to do with the Discrete-Head LX-5 by switching between "Tape" and "Source" and adjusting the bias control until the sound quality is the same. The control's center detent marks the correct setting for Nakamichi tapes.

Controls Behind Hinge Panel

Remote Control

You can command the LX-5 and LX-3 remotely via the optional RM-200 Remote Control Unit. From your armchair, you can delete commercials from an FM broadcast, eliminate selections from a disc you are recording, or perform any other function which normally would be handled by the deck's local mechanical controls.

Unattended Recording and Playback

Connect the LX-5 or LX-3 to an ordinary electrical timer, and you can have the recorder wake you with music in the morning, turn itself off when you retire, even record a "not-to-be-missed" FM broadcast while you are away!

Rec Mute

Whenever the Rec Mute switch is depressed, the tape continues to move but no new information is recorded. With Rec Mute you can erase unwanted material, edited out unnecessary announcements during recording, and create blank sections of tape whenever you wish.

Display

50 dB Wide-Range LED Peak-Reading Meter

Each of the two electronic recording-level indicators spans an exceptionally wide range — from −40 dB to +10 dB — to encompass the dynamics of modern program material. The 16 LED segments in each channel provide excellent resolution and accurately respond to peak recording level even during brief transients.

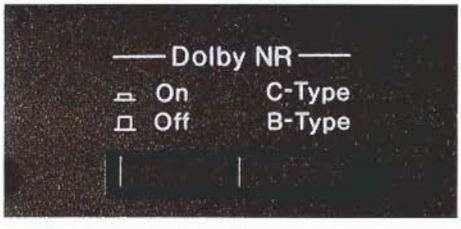
LED 4-Digit Tape Counter

The LX-5 and LX-3 feature an advanced bi-directional electronic tape counter that counts to 9999 when tape is moving in the forward direction and to −999 in rewind. When the Memory switch is activated, the deck stops automatically at a precise indication of 0000 during fast forward or rewind.

Dolby B-C Type NR

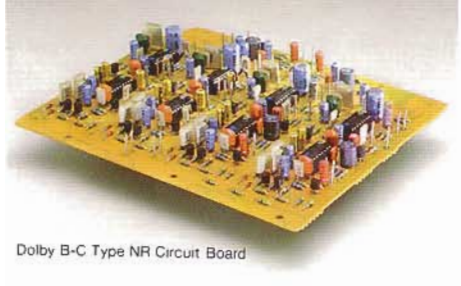
New Dolby C-Type NR System Banishes Audible Hiss Almost Entirely While Conventional B-Type NR Maintains Compatibility With Existing Tapes.

With the narrow tracks and slow tape speed used in cassette recording, "hiss" has been a perennial problem — so much so that the cassette did not achieve "high-fidelity" status until a viable noise-reduction system was developed. The most successful and widely used system to date has been Dolby-B NR, yet, when recording "difficult" program material, some hiss remains even with it. The new Dolby C-type NR system is a vast improvement over its predecessor. In the 2 kHz to 8 KHz region where hiss is most audible, C-type NR is *twice* as effective as B-type — 20 dB improvement versus 10 dB — *without* the "beathing" that affects most other techniques. Both the LX-5 and the LX-3 are equipped with the new Dolby-C NR system as well as with conventional B-type NR for tape collections already encoded in that format.



Dolby-C Operation Principle

Dolby C- and B-type NR operate on similar principles. Low-level signals in the region where hiss is most audible are compressed in recording and expanded in a compensatory manner in playback. The expansion restores the original dynamics and reduces any noise introduced by the tape-recording process. To ensure that sound quality is not impaired, the compression/expansion is limited to 10 dB per circuit, "B" NR employs one processor and achieves 10 dB noise suppression; "C" NR utilizes two stages to achieve 20 dB quieting. Dolby-C NR also is effective over two extra octaves and includes spectral-skewing and anti-saturation circuits to avoid tape overload at high frequencies. Both systems use a "sliding-band" technique (operating frequency varies with signal level) to suppress the "breathing" that plagues many other NR techniques.



Dolby B-C Type NR Circuit Board

Dolby-C Performance

The low-level (−60 dB) encoding characteristics for B- and C-type NR are compared in Figure 1.

The decoding curves (playback) are the exact inverse and thus result in falt overall record/play response. Compared to B-type NR, "C" processing reduces noise twice as much in the 2 kHz to 8 kHz range (an extra 10 dB), and noise reduction begins two octaves lower in frequency. The spectral-skewing and anti-saturation networks come into play above 8 kHz. These circuits prevent cross modulation of low and high frequencies, suppress tape saturation when large signal transients are present, and serve to increase the effective headroom at high frequencies. This can be seen in the upper curves of Figure 2 which show that the frequency response of the Nakamichi LX-5 is flat to 20 kHz at the 0 dB recording level when C-type NR is used! And, A-wtd S/N is 70 dB (re 3% THD at 400 Hz) with no degredation of sound quality even with the most difficult-to-record music.

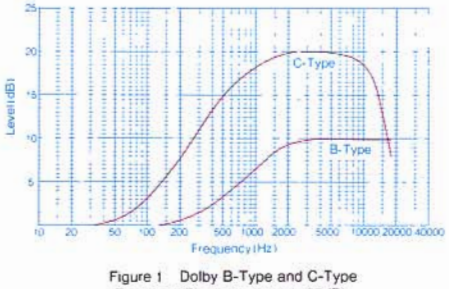


Figure 1 Dolby B-Type and C-Type Encoding Characteristics (−60dB)

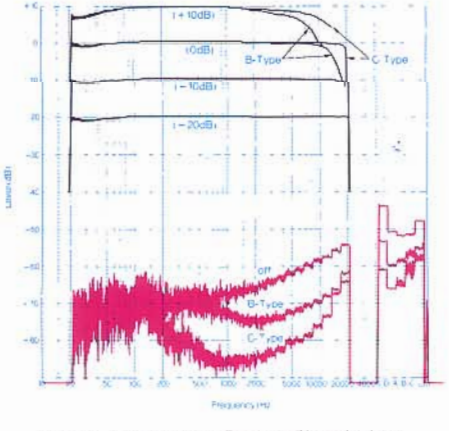


Figure 2 LX-5 Frequency Response/Noise Analysis
Tape Deck Nakamichi LX-5/Tape Nakamichi ZX (Metal)/PB Eq. 70μs

Mechanism

A Unique Asymmetrical, Diffus Dual-Capstan Drive Ensures S And Eliminates Scrape Flutter

The tape transport used in the LX-5 and LX-3 is closely akin to the mechanism used in the state-of-the-art Nakamichi 1000ZXL. This unique drive not only ensures extremely stable tape motion but virtually eliminates common-mode resonance, scrape flutter, and modulation noise, Conventional flutter specifications ignore these anomalies which frequency modulate the music and create a "thick" indistinct sound.

Asymmetrical, Diffused-Resonance, Dual-Capstan Transport

While dual-capstan transports are quite common, that employed in the LX-5 and LX-3 is truly unique. Dual-capstan systems grip the tape between pairs of capstans and so help maintain constant tension despite varying friction within the cassette. However, when the capstans rotate at the same rate, they resonate and concentrate wow at certain frequencies. This is much more audible than conventional specifications would suggest. Nakamichi transports are unique in employing "Asymmetrical" capstans that rotate at different rates. Thus, the capstans cannot resonate with each other and increase audible wow.

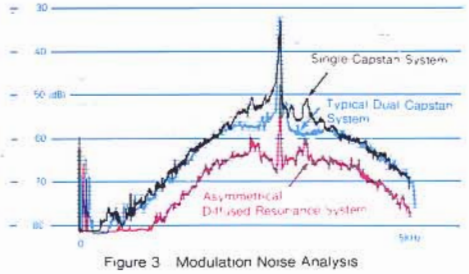
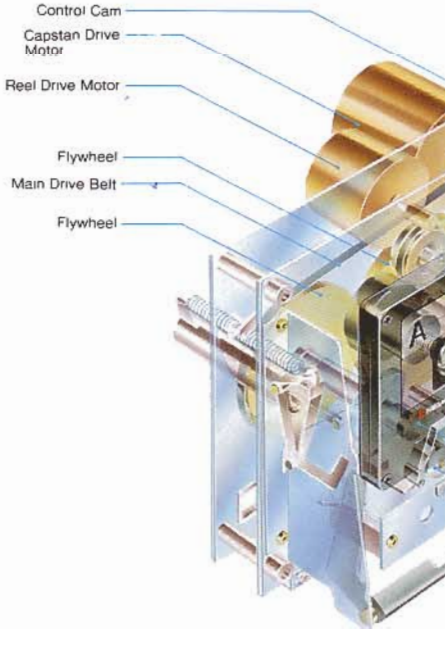


Figure 3 Modulation Noise Analysis



ed-Resonance,
able Tape Transport
And Modulation Noise.

Heads/Electronics

Nakamichi's Extraordinary Expertise In Magnetic Head Technology And Electronic Design Achieve Ultra Wideband Response.

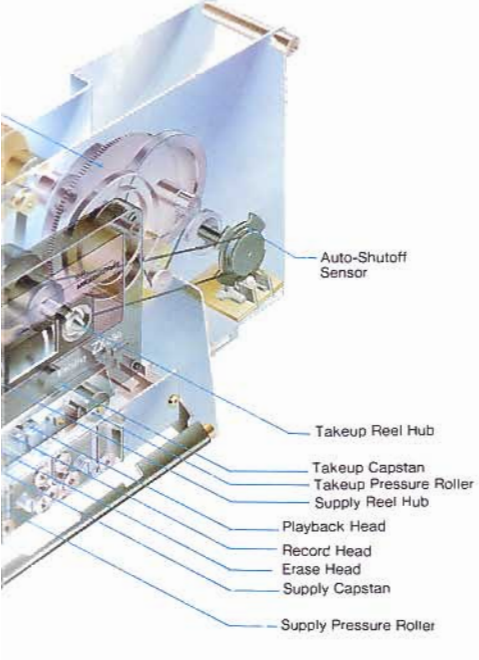
Friction causes the tape to scrape by the head and create "scrape flutter" (ignored by conventional flutter meters) and "modulation noise" (not specified at all). Both phenomena result in "thick" indistinct reproduction. In large measure, these anomalies are caused by the cassette pressure pad normally used to maintain tape-to-head contact. In Nakamichi transports, tape tension is maintained so precisely that the pressure pad is unnecessary. A unique mechanism forces it out of the way and thus eliminates the flutter and modulation noise induced by its presence. A comparison of the performance of Nakamichi transports with conventional single- and dual-capstan designs is shown in Figure 3.

Vibration Absorbing Chassis

Minute vibrations created by the motors and other rotating components create flutter and modulation noise too if they are allowed to enter the tape path. Thus Nakamichi transports are constructed from a special resin-coated aluminum alloy that absorbs and damps vibration before it can affect tape motion.

Silent Mechanism

A unique motor-driven cam performs all mechanical functions normally assigned to solenoids. The motor-driven cam creates less noise, heat, and vibration and is more gentle and precise in operation. The cam motor is microprocessor controlled to eliminate operator error and provide a variety of features. The LX-5/LX-3 capstan motor is a DC servo type whereby speed error is detected as a change in voltage which immediately corrects the error condition.



Head Technology

Discrete Three-Head System (LX-5)

The LX-5 features Nakamichi Discrete-Head Technology in which record, play, and erase heads are mechanically and electrically independent. Mechanical independence reduces crosstalk and allows each head to be contoured for smoothest response and adjusted for optimum magnetic azimuth alignment. Record and play heads are placed close together in the central cassette opening to provide immediate monitoring of the recording as it is being made. The erase head is located at the smaller opening to the left. All three heads are between the two capstans to take advantage of the stable tape tension and uniform tape-to-head contact in that area.

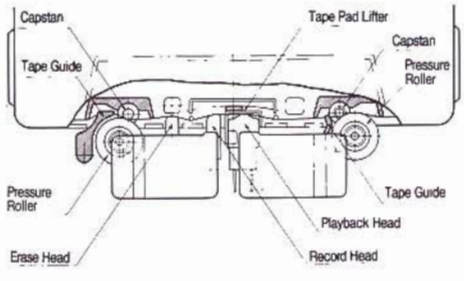


Figure 4 Discrete Head Configuration (LX-5)

Playback Head

The exclusive Nakamichi P-8L playback head has an extraordinarily narrow gap (0.6 microns) to realize exceptional high-frequency performance. Its laminated Crystalloy core has extremely high permeability and very low coercivity to maximize signal-to-noise ratio.

The head is carefully shaped to eliminate "contour effect" (irregular bass response) and to prevent uneven wear. As a result, response extends from 20 Hz to 20 kHz, and life expectancy is over 10,000 hours.

Recording Head

The R-8L recording head also features a laminated Crystalloy core to take advantage of the low coercivity and high flux handling properties of this unusual material. Recording gap is 3.5 microns to utilize the full tape coating. An extremely sharp critical recording

zone optimizes high-frequency performance, and the poletips are shaped to prevent core saturation when high bias and recording currents are utilized. Its special geometry ensures a head life of over 10,000 hours.

Erase Head

The E-8L erase head combines the best properties of ferrite and sendust. The internal core is a ferrite that has very low loss at the ultrasonic erase frequency. The poletips are sendust to take advantage of the extremely high saturation induction of this material. Dual gaps ensure full erasure. The first gap eliminates the majority of previously recorded material; the second gap removes the last vestige of what remains.

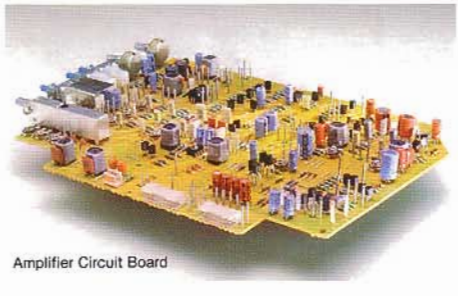
Two-Head System (LX-3)

The two-head LX-3 recorder employs the RP-9E combination record/play head. While some compromise is inherent in any head that serves two purposes, the RP-9E is truly remarkable. By utilizing a sendust material with extraordinarily high saturation induction, the effective magnetic gap can be made sufficiently narrow to achieve full 20 kHz response — a feat not matched by many three-head decks! Yet there is not the slightest trace of core saturation even when recording high-coercivity metal tape. The LX-3 employs the same E-8L erase head used in the LX-5 and other high-quality Nakamichi recorders.

Amplifier

Electronics

The electronic circuitry in a cassette recorder is equally as important as the mechanical transport and the magnetic heads. This is especially true when heads capable of exceptionally wide response are used in conjunction with a superior noise-reduction system and high quality tape. Dolby NR is capable of reducing noise introduced in the record/playback process, but it cannot eliminate electronic noise introduced *prior* to encoding or *after* decoding. These circuits must have exceptionally low noise in and of themselves, and Nakamichi has devoted considerable effort towards improving these electronics and ensuring that only components of the highest quality are used.



Amplifier Circuit Board

LX-5/LX-3 Cassette Decks

A New Recording Era For Contemporary Music Lovers — Nakamichi Performance — Operational Simplicity — A Classic Design Of True Elegance

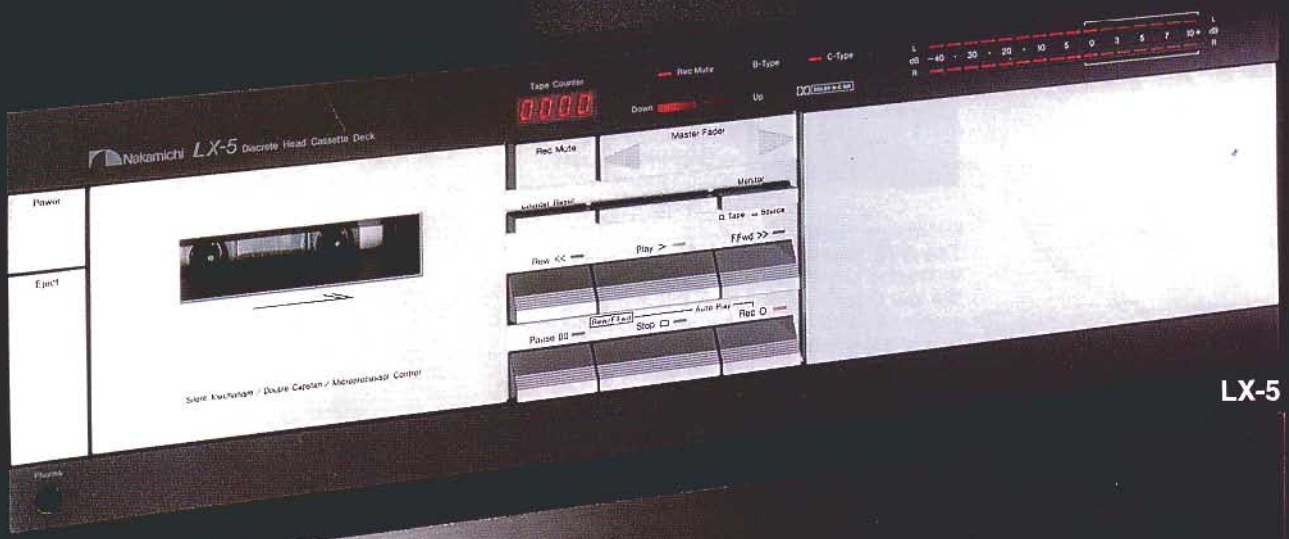
Contemporary music lovers turn to the cassette as their main music source. It is convenient, compact, and, in a quality deck, reliable and capable of remarkable fidelity. Yet, some music devotees shy away from the operational complexity and imposing appearance that characterize many high-performance recorders, Nakamichi does not believe that a cassette recorder need be complicated to use nor unattractive in appearance in order to provide superior sound. The LX-5 and LX-3 are the embodiment of that philosophy.

The LX-5 and LX-3 are simple to operate because their complexity is internal. Microprocessor-controlled transports handle tape gently no matter which function you command. Automatic faders smoothly change recording level for you. Dolby-C noise reduction virtually eliminates tape hiss while B-type NR is compatible with your older tapes. And there are the Nakamichi "standards" — the exclusive Diffused-Resonance Dual-Capstan transport that eliminates scrape flutter and modulation noise, the superior performance of Nakamichi heads and electronics.

LX-5 Discrete-Head Cassette Deck
Completely independent record, playback, and erase heads — and separate Dolby-NR processors — enable recordings to be monitored as they are being made so you are assured of perfect results. Each of the three independent heads, is optimized for its sole function.

LX-3 Two-Head Cassette Deck
The extraordinary performance of the combination record/play head employed in the LX-3 provides sound quality on a par with most 3-head decks. Compare specs and you'll see!

LX-3



LX-5

Features

(LX-5 only)
- Discrete 3-Head Technology With 20–20,000 Hz Response
- Laminated Crystalloy Record And Playback Heads
- Full Off-Tape monitoring Via Double NR Systems
- Punch-In Recording

(LX-3 only)
- Sendust Combination Record/Play Head With 20–20,000 Hz Response

Common Features
- Dual-Gap Ferrite/Sendust Erase Head For Low-Noise Erasure
- Bias-Tune Control For Best Performance With Many Tapes
- Separate Tape And Equalization Switches For ZX, SX, and EX Tapes
- Dolby-B And Dolby-C Noise Reduction With Defeatable MPX Filter
- Individual Left And Right Input-Level Controls
- Automated Fade-Up/Fade-Down With Choice Of Fade Rate
- Asymmetrical, Dual-Capstan, Diffused-Resonance Transport With Motor-Driven Cam, Dual Slot Guides, And Tape-Pad Lifter
- 4-Bit N-MOS Microprocessor Control With Automatic Playback, Rec. Mute, High-Speed Shutoff, And Slack-Tape Takeup
- 50-dB Peak-Responding Electronic LED Metering
- Output-Level Control
- 4-digit LED Electronic Tape Counter (−999 to 9999) With Tape-Start Memory
- Unattended Operation In Record Or Playback Via Accessory Timer
- Total Remote Control Via RM-200 Option

- Specifications and appearance design are subject to change for further improvement without notice.
- Dolby NR under license from Dolby Laboratories Licensing Corporation.
- The word "DOLBY" and the Double-D-Symbol are trademarks of Dolby Laboratories Licensing Corporation.

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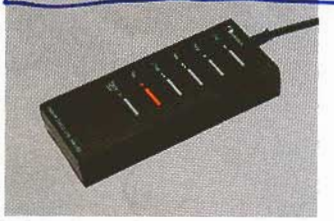
SP-7 Stereo Headphones



RM-200 Remote Control

LX-5/LX-3 Specifications

Track Configuration	4 tracks/2-channels stereo
Heads	LX-5: 3 (erase head x 1, record head x 1, playback head x 1) LX-3: 2 (erase head x 1, record/playback head x 1)
Motors (Tape Transport)	DC servo motor (capstan drive) x 1 DC motor (reel drive) x 1
Power Source	100, 120, 120/220-240, 220 or 240V AC; 50/60Hz (According to country of sale)
Power Consumption	33 W max.
Tape Speed	1-7/8 ips. (4.8 cm/sec.) ±0.5%
Wow-and-Flutter	Less than 0.11% Wtd peak Less than 0.06% Wtd rms
Frequency Response	20 Hz-20,000 Hz (recording level −20 dB, ZX, SX, EX II tape)
Signal to Noise Ratio	**Dolby C-Type NR on** (70μs, ZX Tape) LX-5: Better than 70 dB (400 Hz, 3% THD, IHF A-Wtd rms) LX-3: Better than 68 dB (400 Hz, 3% THD, IHF A-Wtd rms) **Dolby B-Type NR on** (70μs, ZX tape) LX-5: Better than 64 dB (400 Hz, 3% THD, IHF A-Wtd rms) LX-3: Better than 62 dB (400 Hz, 3% THD, IHF A-Wtd rms)
Total Harmonic Distortion	LX-5: Less than 0.9% (400 Hz, 0 dB, ZX tape) Less than 1.0% (400 Hz, 0 dB, SX, EX II tape) LX-3: Less than 1.0% (400 Hz, 0 dB, ZX, EX II Tape) Less than 1.2% (400 Hz, 0 dB, SX Tape)
Erasure	Better than 60 dB (100 Hz, 0 dB)
Separation	Better than 36 dB (1 kHz, 0 dB)
Crosstalk	Better than 60 dB (1 kHz, 0 dB)
Bias Frequency	105 kHz
Input (Line)	50 mV, 70 kΩ
Output (Line)	1V (400 Hz, 0 dB, output level control at max.), 2.2 kΩ
(Headphones)	12 mW (400 Hz, 0 dB, output level control at max.) 8Ω load
Dimensions	450(W) x 135(H) x 307(D) millimeters 17-3/4(W) x 5-5/16(H) x 12-1/16(D) inches
Approximate Weight	8.5 kg, 18 lb. 12 oz

Tapes

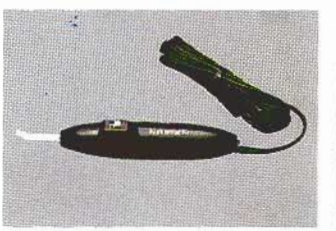
ZX Metalloy Cassette Tape (70 μs, metal bias)
ZX C-60 ZX C-90

SX Ferricobalt Cassette (70 μs, CrO_2 bias)
SX C-60 SX C-90

EX Ferrioxide Cassette Tape (120 μs, normal bias)
EX C-60 EX C-90

SX II Super Ferricobalt Tape (70 μs, CrO_2 bias)
SX II C-60 SX II C-90

EX II Ferricrystal Cassette Tape (120 μs, normal bias)
EX II C-60 EX II C-90



DM-10 Head Demagnetizer

SF-10 Subsonic Filter

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