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**NAKAMICHI
700 ZXL
CASSETTE
DECK**

Manufacturer's Specifications

Frequency Response: 20 Hz to 20 kHz, ± 1.5 dB; 18 Hz to 24 kHz, ± 3 dB.

Harmonic Distortion: 0.8% for 400 Hz at 200 nWb/m.

S/N Ratio: 66 dBA with Dolby B NR.

Separation: 37 dB.

Crosstalk: 60 dB.

Erasure: 60 dB at 100 Hz with metal tape.

Input Sensitivity: Mike, 0.2 mV; line, 50 mV; NR, 100 mV.

Output Level: Line, 1.0 V; headphone, 45 mW; to external NR, 100 mV.

Flutter: 0.04% W rms, 0.08% wtd. pk.

Dimensions: 19-11/16 in. (500 mm) W x 10-5/16 in. (262 mm) H x 9 7/8 in. (250 mm) D.

Weight: 30.8 lb. (14 kg).

Price: \$3,000.00.



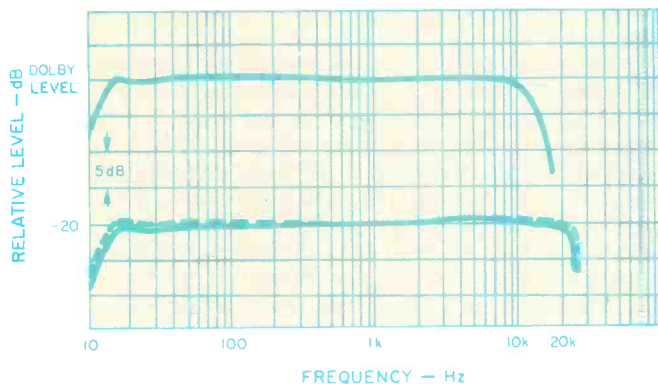


Fig. 1—Frequency responses using Nakamichi EX II tape with and without (dashed line) Dolby B noise reduction.

The Nakamichi 700 ZXL cassette deck can be thought of in different ways: As a very high priced recorder with outstanding performance, or perhaps as the Nakamichi unit which matches the 1000 ZXL in most respects for \$800.00 less. (Additional details on some of the features to be described here may be found in the June 1981 "Equipment Profile" of the 1000 ZXL.) The 700 ZXL is immediately impressive because of its size and weight. The top and bottom of the front panel continue the jet black of the rest of the cabinet, while the brushed-aluminum center portion stands in vivid contrast to the black, adding to the overall attractiveness. In the top section are three displays. The one at the left has a series of annunciators that show the status of A.B.L.E. (the auto-calibration processor), tape selection, EQ, noise-reduction mode and RAMM (Random Access Music Memory). Once started with *Auto Cal/Run* in record mode, A.B.L.E. automatically adjusts azimuth, bias, level (record sensitivity) and record equalization for any tape formulation. There are regular bias and EQ switches which act as presets for adjustment ranges, and illogical combinations will be rejected by A.B.L.E. after a few adjustments. For example, it will adjust the deck for SX (Type II) tape for 120- μ S EQ, but not for ferric-level bias. Such a rejection is indicated by the A.B.L.E. annunciators, *Bias*, *Level* and *EQ*, flashing until a correct choice is made — an excellent implementation of this scheme.

When auto calibration is completed, the results can be entered into any one of four memories, including the noise-reduction setting: *Out*, *Dolby NR* (the built-in Dolby B scheme) or *Ext* (designed for the Nakamichi High-Com II or the NR-100 Dolby C add-ons). A manual setting facilitates changing just the EQ or the NR mode if that is desired. Green indicators show which memory is being used and whether *Manual Set* is active.

Other annunciators in the first (left) top-of-panel display show when RAMM mode is active and what the program condition is. RAMM is similar to a number of other systems in that it allows the playing of a number of selections in any desired order to be programmed. RAMM is unique, however, in that it encodes information on playback EQ and NR status for decoding in subsequent playback — a feature that is certain to be very helpful to some. In the center is the four-digit tape counter, which provides more resolution for exact location.

The right-hand top-of-panel display consists of the two horizontal LED-type bar graph level meters, each with 30 segments. These peak-responding devices cover a 50-dB range from -40 to +10 dB, with momentary holding on any peaks to aid in record-level setting, an excellent combination.

Loading a cassette is a simple drop-in process, and the compartment door closes smoothly with a firm push. *Eject* is below and to the left, and it requires a push to the left for actuation. This seems a little odd, because it is different from most, but it certainly will not be mistaken for tape motion buttons, which are wide, knurled bars which require just light touches for the logic to take over. *Pause*, *Stop*, *Play* and the wind buttons all have green indicators; *Record* has red. There is some interlocking in the logic, which prevents adding record to play, but there are other uses for these buttons. For example, record muting is obtained by holding in *Record* while in that mode. Also, if *Pause* is pushed during fast wind, the 700 ZXL goes into a cue mode with wind reduced to one-third speed. Holding in a wind button will reduce speed further to one-fifth that of normal. When a cassette is inserted, there is some automatic take-up to eliminate



The 700 ZXL easily meets its demanding record/playback specifications of ± 1.5 dB, and it does so with all three tape formulations.

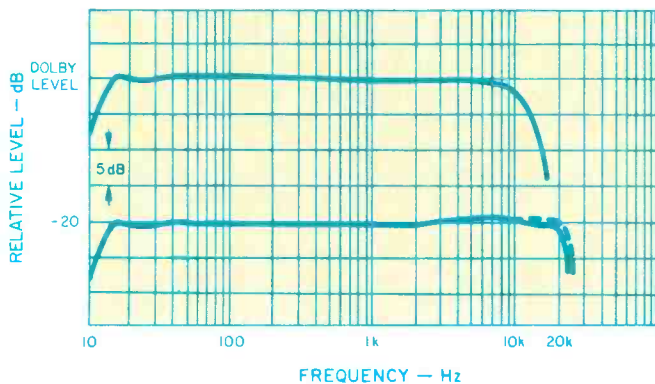


Fig. 2—Frequency responses using Nakamichi SX tape with and without (dashed line) Dolby B noise reduction.

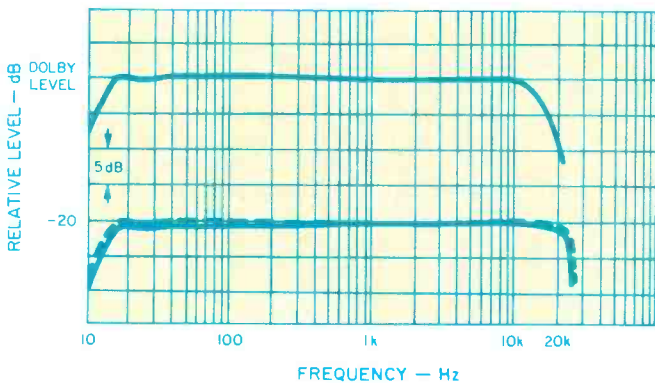


Fig. 3—Frequency responses using Nakamichi ZX tape with and without (dashed line) Dolby B noise reduction.

any slack in the cassette. For a start at the absolute beginning of a cassette, it may be necessary to rewind slightly.

In the right half of the center section is a swing-out panel which covers a number of controls and switches not necessarily needed in day-to-day use. A light touch on the upper-right corner, and it swings up and out of the way. Revealed are the tape bias and EQ selectors; the noise-reduction mode switch; input pots for left, right, and blend microphones; the output level pot; the play speed/pitch control ($\pm 6\%$), and switches for timer (*Record/Off/Play*), memory (*Stop/Off/Play*), 400-Hz test tone for external NR calibration (*Off/On*) and Filter (*Subsonic/Off/MPX*). Most of the above are well understood, but comments are in order for two of them. The output of a microphone fed into *Blend* goes into both left and right channels, providing a simple and effective way of getting a centered sound image, such as with a vocal, without the use of a separate mixer. The subsonic filter is useful in two ways: it can be used to reject low-frequency spurious signals such as from record warps, and it is needed

with the RAMM to keep its 5-Hz code signals out of the music signal flow.

In the bottom black section on the left are five small buttons for RAMM (*RAMM*, down [arrow], up [arrow], *Set* and *Reset*). *RAMM*, of course, puts the deck into that mode, and the others control programming for playing up to 15 selections in any sequence up to a total of 30 plays. When recording a series of selections, the encoding and numbering can be automatic or manual. Just to the left are the power on/off switch and the headphones jack. To the right are the two *Auto Cal* buttons, *Azimuth* and *Run*, both with green indicators. Starting *Auto Cal* (from *record/pause* to *Run/play*) results in automatic record-head azimuth alignment, and *Azimuth* flashes during this process. When it stays off, adjustments in bias, level and EQ are made, with the associated annunciators flashing indications of the steps being taken. If a tape has already been matched, but there is some question on alignment, then just that button is pushed. The detailed information on any set of adjustments for any formulation can be entered into tape memory (positions A to D) with select buttons on the right-hand side of the bottom strip. After an *Auto Cal*, *Standby/Set* indicates that a memory can be selected. Once that is done, the settings for that tape will remain in memory, even with power off, as there are memory back-up batteries just for this purpose. The *Manual Set* button permits making a change in EQ or NR mode as desired. Green status bars remind the user of memory condition. Just to the left in the middle of the bottom strip are the counter reset button and the tape/source monitor switch. At the right end is the dual-section friction-coupled line-input pot with a split-bar knob which allows easy adjustment of levels for the two channels, separately if desired. There is complete mixing capability between the line inputs and those for microphone.

On the back panel are the four line-in/line-out jacks and the eight NR encoder/decoder in/out jacks, all gold plated. There are also DIN-type sockets for the RM200 (transport only) and RM300 (full function including RAMM) remote controls and the NR-100 Dolby C add-on. The memory back-up battery compartment for two AA cells is here too.

The steel top and side cover was removed for an examination of the internal construction. The inside surface of the top was covered with a rubberlike pad, probably to make things more snug and to damp out any panel vibrations. The soldering on the many p.c. boards was excellent, with just occasional flux residue at a couple of the hand-wired points. There were about 10 good-sized cards with several smaller ones, all with high-quality components. Parts were identified on both sides of the cards, but servicing on this deck is best left to the experts. The chassis construction was quite rigid, and the sophisticated, dual-capstan tape drive with the cam system and the auto-azimuth alignment scheme was impressive.

Measurements

The playback responses of this Nakamichi deck were excellent for both equalizations, within a dB except for one single low-frequency point. The play speed was just 0.1% slow, and the meter indications for a standard level was just a fraction of a dB low. Many different tape formulations were tried with the 700 ZXL, and A.B.L.E. achieved excellent results with all of them. All of the subsequent tests, however, were run with three Nakamichi tapes provided with the deck.

The auto-calibration processor, dubbed A.B.L.E., is the star of the show, making a series of adjustments in seconds.

With a specified 20 Hz to 20 kHz response ± 1.5 dB, the recorder called for a critical examination. Record/playback responses were taken at Dolby level and at 20 dB below that, both with Dolby B NR and without it. Figures 1 to 3 show that the deck easily met the demanding ± 1.5 dB limitation, both with and without Dolby NR. It should be kept in mind that the results were obtained from computer-derived information for deck settings that were retrieved from memory. The Dolby tracking was generally excellent, including close-to-exact matches at Dolby level. Table I lists all of the 3-dB down points, and all are better than the specifications, particularly at the low end. Note the high-frequency headroom evidenced in the Dolby-level plots and the flatness of all of the responses.

The auto-azimuth alignment scheme was checked by the record/playback of a 10-kHz tone at the completion of the process. There was just 20° phase discrepancy between the tracks, one of the best to date. The phase jitter with the same tone was only 10°, the best seen to date. The multiplex filter was 1 dB down at 15 kHz and 31.4 dB at 19 kHz. The subsonic filter was 1 dB down at 30 Hz, -3 dB at 27 Hz, and -10 dB at 25 Hz. This is more attenuation than would be needed for some purposes, but to ensure proper RRAM encoding and decoding and minimum effect on the music, the 5-Hz code signal must be reduced greatly. The bias in the output during recording was very low, much better than most recorders. There was no 15-kHz loss measured with repeated replays using tapes known to be sensitive to certain decks. The 400-Hz (390-Hz actual) oscillator had just 0.22% distortion, plenty low enough for its intended purpose. The separation at 1 kHz was 51 dB, noticeably better than the 37-dB spec. The crosstalk at the same frequency was down more than 85 dB, and erasure was down more than 75 dB at 100 Hz with metal tape, both better than spec and quite excellent.

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

| Tape Type | With Dolby B NR | | | | Without Dolby NR | | | |
|-----------------|-----------------|------|--------|------|------------------|------|--------|------|
| | Dolby Lvl | | -20 dB | | Dolby Lvl | | -20 dB | |
| | Hz | kHz | Hz | kHz | Hz | kHz | Hz | kHz |
| Nakamichi EX II | 12 | 12.4 | 14 | 24.3 | 12 | 12.4 | 12 | 25.7 |
| Nakamichi SX | 12 | 11.7 | 12 | 24.5 | 12 | 11.9 | 12 | 25.2 |
| Nakamichi ZX | 12 | 15.2 | 14 | 25.2 | 12 | 15.4 | 12 | 25.7 |

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

| Tape Type | IEC A Wtd. (dBA) | | | | CCIR/ARM (dB) | | | |
|-----------------|------------------|-------|------------|-------|---------------|-------|------------|-------|
| | W/Dolby NR | | Without NR | | W/Dolby NR | | Without NR | |
| | @DL | HD=3% | @DL | HD=3% | @DL | HD=3% | @DL | HD=3% |
| Nakamichi EX II | 58.5 | 63.2 | 49.5 | 53.8 | 57.2 | 61.9 | 46.4 | 50.7 |
| Nakamichi SX | 61.6 | 67.6 | 52.3 | 57.5 | 60.8 | 66.8 | 50.0 | 55.2 |
| Nakamichi ZX | 61.2 | 70.4 | 52.2 | 60.9 | 60.1 | 69.3 | 49.3 | 58.0 |

The third harmonic distortion was measured with a 1-kHz tone from -10 dB to the point where $HDL_3 = 3\%$ for the three tapes with Dolby B NR. Figure 4 illustrates that the distortion was very low for all of the tapes, but especially so for the ZX metal-particle formulation. This is in refreshing contrast to the "metal compatible" decks that actually have poor distortion performance with Type IV tapes. Also note the very high (+10.4 dB

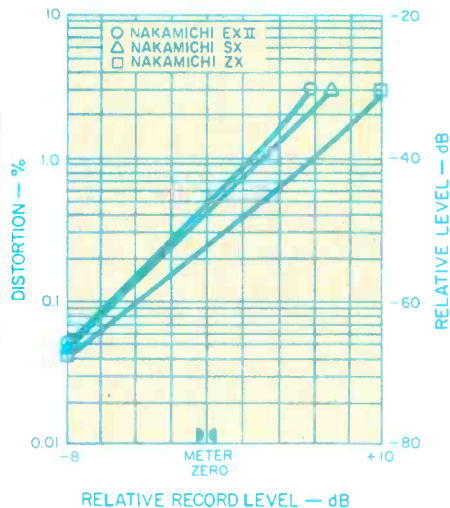


Fig. 4—Third harmonic distortion at 1 kHz vs. record level, using Dolby B noise reduction.

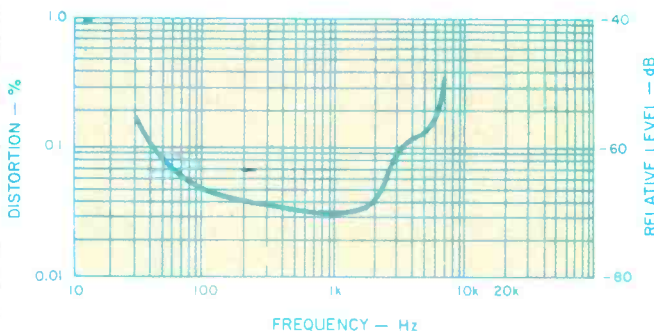


Fig. 5—Third harmonic distortion vs. frequency at 10 dB below Dolby level using Dolby B noise reduction with Nakamichi ZX tape.

exactly) 3% MRL with ZX. Distortion was about 30% higher without Dolby B NR. It was difficult to get precise distortion figures at -8 to -10 dB because of noise effects, but they were very close to 66 dB down from the fundamental or a superbly low 0.05% HDL_3 vs. frequency was measured from 30 Hz to 7 kHz at -10 dB in Dolby B mode with ZX tape (Fig. 5). Distortion across the band was very low — the best ever seen, with just 0.032% (!) at 1 kHz. The sharp rise to 7 kHz is not very high, and it's not too surprising as the 700 ZXL is one of the few decks that is flat to 21 kHz (third harmonic of 7 kHz).

The input sensitivities were 0.17 mV for mike and 50 mV for line, both good, low voltages. The input overload points were an incredible 2.3 volts for mike and over 30 volts for line. Output clipping appeared at a level equivalent to +17.1 dB relative to meter zero, one of the best ever measured. The line input pot sections tracked within a dB from maximum down more than 60 dB, noticeably better than most. There was some variation in the input impedance with rotation of the pot, but the values were 20 kilohms or above, even at 20 kHz, in all cases. The line output

While the Nakamichi 700 ZXL does have a high price, the deck offers performance which is unsurpassed overall.

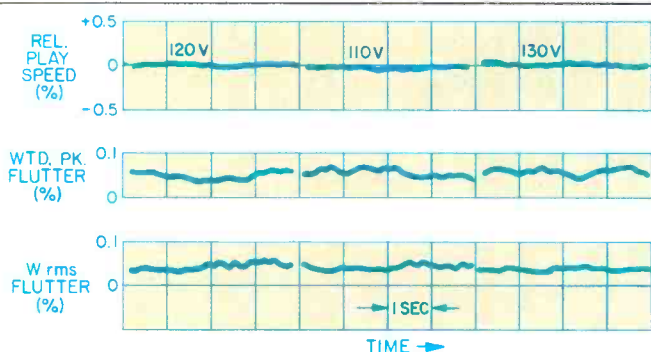
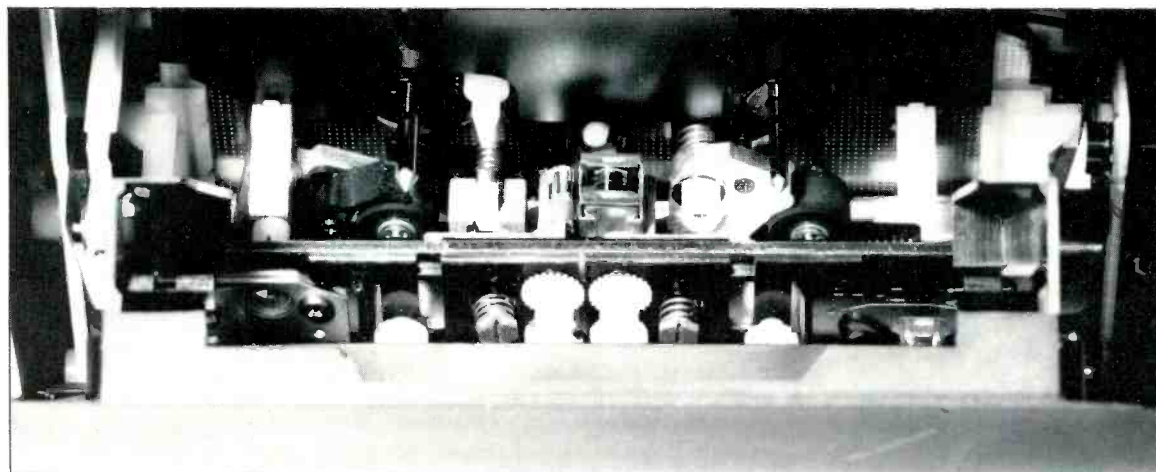


Fig. 6—Tape play speed vs. time and line voltage, and wtd. peak and wtd. rms flutter (three trials each).

was 990 mV, slightly below spec, with high-Z loading. With a 10-kilohm load, this dropped to 817 mV, the expected result with the 2.2-kilohm source impedance.

The headphone output was 554 mV to 8 ohms or 38 mW — lower than the 45 mW specified for an unstated load. A very high level was possible, however, with all of the headphones tried, and the level could be easily set to suit with the output level pot. That control tracked within a dB from maximum down about 45 dB, quite acceptable for this function. The bar graph level meters were 10 dB down with a 10-mS burst and required a 100-mS duration to reach zero. They thus should be described as fast-response meters, rather than peak responding. The decay time was 1.8 S, which is to the IEC standard. Meter indications were 3 dB down at 7 Hz and 21.2 kHz.

Tape play speed wandered very little with time, and the average speed changed just slightly with shifts in line voltage. The flutter was very low, $\pm 0.058\%$ weighted peak and 0.039% W rms, and the values were quite constant with time — much steadier than with most decks. The wind times for a C-60 were 45 seconds, fast and smooth. The 700 ZXL pitch control had a range from -6.7 to $+7.8\%$ (semitone = 5.9%) of normal play speed. Run-out to stop from wind or play took less than a second, as did any other mode change.

Use and Listening Tests

Tape loading and unloading were easy and convenient, more so after learning the position of *Eject* below and to the left. Access was quite good with the compartment door open, but some tasks were best done with the window/cover removed, the door closed, and the deck in play. All of the tape motion controls were completely reliable, including use of the cueing scheme and record muting. RAMM performed faultlessly, but some familiarization time was needed for use with minimum fuss. The star of the whole show was A.B.L.E. with its outstanding capability to make in seconds a whole series of adjustments that would be a challenge on anyone's test bench. Tape memory proved to be an essential and valuable adjunct in regular use of the deck. For much of the testing, of course, it was only necessary to use *Azimuth* in addition to selecting the correct memory. The annunciators were of great assistance at times, including cases of incorrect tape-type settings.

I did not have occasion to use the three-mike recording scheme, but since I use "centered" mikes regularly with my mixers, I can attest to the value of the blend microphone. All switches and controls had a good feel to them, especially the line-input pot. The meters gave excellent indications for setting levels, and the temporary peak holds in each channel helped in that regard. They were easy to read under a wide range of lighting conditions. The owner's manual has text that is direct, but quite detailed in 30 plus pages. There are many excellent illustrations, including the seven-page section on RAMM. There are extensive maintenance instructions with worthwhile cautions that should be followed.

Sources for the record/playback listening tests included pink noise and a number of discs, mostly from Mobile Fidelity and dbx. The Dolby matching was obviously excellent, and the sonic results were very fine even with some portions that were recorded at over-normal levels. Record, pause, and stop noises were all quite low — down into tape noise. Timer start went into play or record, as selected, after a five-second delay after power turn-on. The Nakamichi 700 ZXL has a very high price. For that, this deck offers performance that is unsurpassed overall.

Howard A. Roberson

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