

Nakamichi 680ZX Cassette Recorder



General Description: The top model in Nakamichi's recently introduced "ZX" series, the model 680ZX is a three-head cassette recorder of high performance and several innovative, and worthwhile, features. It is metal-tape capable; it operates at two speeds ($1\frac{5}{8}$ ips in addition to the standard $1\frac{7}{8}$ ips); it includes the random access music memory (RAMM) system for automatic search and play of specific selections on a tape; and it provides for automatic alignment of the separate recording head. Unattended playback and recording can be accomplished with the use of an external timing device, and remote control is possible with the use of Nakamichi's model RM-200 r-c accessory.

The tape drive uses a double-capstan, closed-loop system, and the two capstans are of different diameter and are driven at different speeds. This "asymmetrical" design is credited with minimizing any mechanical resonances that could degrade the response. One motor (operating through flywheels of different inertia) drives the two capstans; a second motor is used for reel drive; and a third motor drives a cam that positions the heads against the tape and also engages the reel brakes and other solenoid-controlled operations.

The automatic head alignment is handled by a fourth motor that actually moves the record head while a built-in 400-Hz test tone is applied to the head, and picked off as a difference in phase between the left and right channels at the playback head. Indicators show that the alignment process is under way, and reference cursors appear on the signal meters to indicate when azimuth alignment has been completed. Associated with this procedure is the record-calibration via screwdriver adjustments found on the front panel below the meters. There are twelve such adjustments: two groups of six for the two speeds at which the deck operates, and each group containing left- and right-channel screws for each of three basic kinds of tape—EX (standard); SX (high bias); and ZX (metal). These designations also appear on the separate bias

and EQ switches provided elsewhere on the panel for tape-type selection.

A cueing system, not unlike that found on many open-reel decks, is provided on the Nakamichi 680ZX. When the deck is in rewind or fast-forward, pressing the pause button reduces the winding speed and also brings the playback head closer to the tape so that a high-pitched signal may be monitored as an aid in rapidly locating a desired portion of the tape.

For locating a known portion of a tape, the memory switch may be used in conjunction with the tape counter so that during rewind the transport can be made to stop at any desired spot.

The RAMM system itself operates by sensing and counting the number of silent spaces between selections on a recorded tape. In a sense, it "listens" for you while the tape is being moved. You can "instruct" the RAMM to count up to eighteen blank spaces.

The model 680ZX is strictly a line-level input deck. It has no microphone jacks or microphone preamps. For "live" recording with mics, Nakamichi explains that an external mic-mixer (such as its own MX-100) must be used. The only signal jack on the front panel is a stereo headphone output jack; the line-in and line-out jacks are at the rear.

The front panel, which is dimensioned and slotted for rack-mounting, is "busy looking" but neatly laid out and legible. The cassette compartment is at the left. To its right are the memory switch, the tape counter and its reset button, and a display area that includes the RAMM indicator, and the deck's signal meters. The latter are horizontal fluorescent bars calibrated from -40 to $+10$. They may be switched to show peak or VU levels. They show signal levels for record and play, and they are used during the azimuth alignment and record calibration procedures. The row of adjustment screws for the calibration is just below the meter panel. To the left of these adjustments is a pitch control, operative on playback over a range of ± 6 per cent.

Further down on the panel are the transport con-

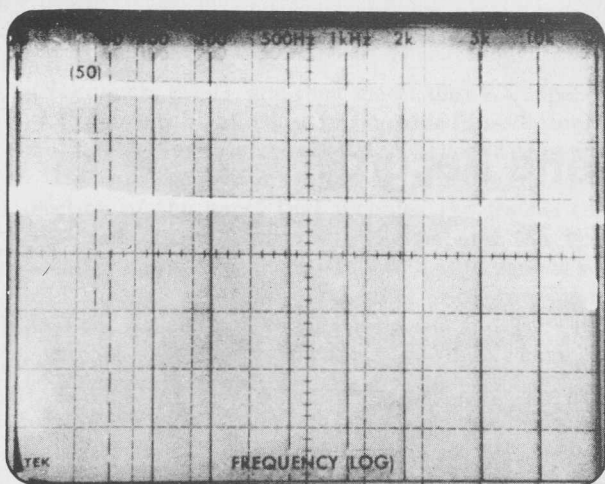


Fig. 2: Nakamichi 680-ZX: Record/play response at 0 dB & -20 dB record level, using Nakamichi EX-II cassette tape (1⁷/₈ ips).

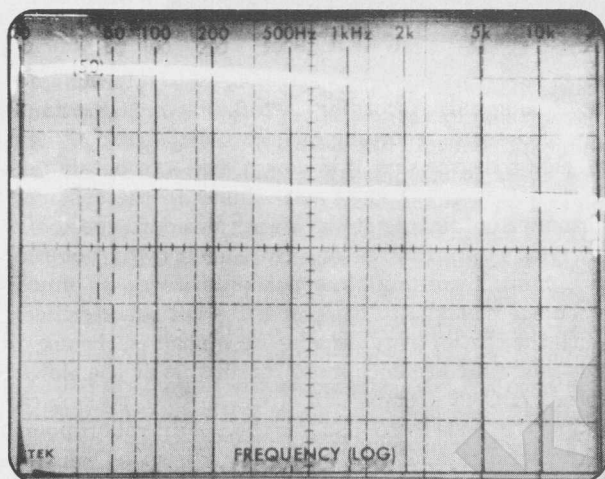


Fig. 3: Nakamichi 680-ZX: Record/play response at 0 dB & -20 dB record level, using Nakamichi SX cassette tape (1⁷/₈ ips).

trols, the tape speed selector, an output level control, dual-concentric input controls for left and right channels and a master input control. This last control may be used as a fader for the program source once the basic level and channel balance have been set on the dual-concentric pair. The transport controls provide for fast-buttoning from one mode to another, except that to go from play to record the stop button must be pressed first. That particular operation is facilitated by the action of these light-touch, fast acting buttons.

At the right end of the panel is a vertical row of switches for tape bias, tape EQ, Dolby system (with a setting for multiplex filter), the metering display, the optional timer, tape/source monitoring and power off/on.

In addition to the line jacks at the rear, there are special sockets for connecting the remote-control accessory, and for supplying a regulated DC voltage to power one or more of Nakamichi's "Black Box" series components, such as the microphone mixer, a subsonic filter, a line amplifier, a bridging adaptor, a booster amp or an electronic crossover. Any combination may be used that does not exceed the socket's rating of 125 mA. For higher current drain, the model PS-100 power supply must be added.

Test Results: The Nakamichi 680ZX was tested at both of its operating speeds and with three kinds of tape (requiring normal bias, high bias and metal bias).

In every test, the deck either met or exceeded its published specifications. These were relatively high to begin with, and their confirmation leads to one inescapable conclusion. With this unit, Nakamichi has gone beyond its own model 1000 and has produced what must be acknowledged as—if not the best-performing cassette deck we have yet encountered—then surely one that is unsurpassed by any other. Significantly, it is the only "metal tape capable" cassette deck we have tested to date that actually does perform better in all tested parameters with metal tape than with other varieties. Even at the unprecedented "half speed" of $\frac{1}{16}$ inches-per-second, the Model 680ZX offers performance that rivals that of other cassette decks operating at the $\frac{1}{8}$ ips speed.

Fig. 1 shows a plot of playback-only frequency response, for the 120- μ sec EQ setting, using TDK test tape AC-337. The plot extends only from 40 Hz to 12.5 kHz simply because these are the extreme spot frequencies on this test tape. More revealing are the record/playback curves (Figs. 2, 3 and 4) which were made—thanks to the three-head configuration of the 680ZX—by means of continuous sweeps using our spectrum analyzer. Figs. 2, 3 and 4 show the results (plotted from 20 Hz to 20 kHz, logarithmically swept) at the -20 dB and the 0 dB record levels, using Naka-

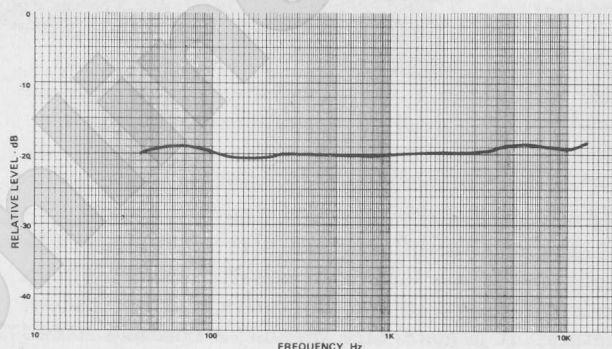


Fig. 1: Nakamichi 680-ZX: Playback-only response at 1⁷/₈ ips, 120 μ sec EQ, using TDK test tape.

michi's EX-II standard tape (Fig. 2), SX high-bias tape (Fig. 3) and ZX metal tape (Fig. 4). The advantage of metal tape, when used on a deck that is properly designed for it, may be readily discerned by comparing the 0 dB (upper) curves in each picture. At 10 kHz in Fig. 4, response is still virtually flat, while in Figs. 2 and 3, response at 10 kHz is already down more than 5 dB owing to tape saturation.

In order to realize the best results from metal tape at the slower $\frac{1}{16}$ ips speed, Nakamichi instructs the user to set the EQ for 120 μ sec instead of the 70 μ sec usually required for metal tape used at the standard $\frac{1}{8}$ ips speed. Following this instruction, we obtained the record/playback curves seen in Fig. 5. As might be expected, at this slow speed the 0 dB response shows saturation at the high end (much like previous tapes at the higher speed), but at the -20 dB record level, the response extends to a bit past 15 kHz before rolling off sharply. This, to repeat, is at $\frac{1}{16}$ ips.

Using our distortion analyzer we plotted 3rd-order distortion at $\frac{1}{8}$ ips. The results, shown in Fig. 6, indicate that the 3rd-order distortion component (using ZX tape recorded at 1 kHz at the 0 dB level) is a full 54 dB down from the fundamental (each vertical division in the photos equals 10 dB). That is equivalent to only 0.2 percent! This measurement, by the way, makes a point often overlooked. If you read THD (total harmonic distortion) on a simple meter-reading distortion analyzer when testing tapes or tape cassettes, what you really are reading is the sum of the various distortion components as well as the contribution to the reading made by random noise. Note that in our "Vital

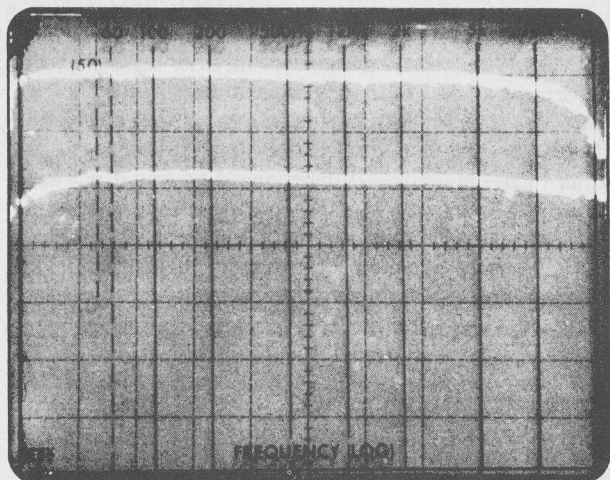


Fig. 4: Nakamichi 680-ZX: Record/play response at 0 dB & -20 dB record level, using Nakamichi metal tape ZX ($1\frac{7}{8}$ ips).

Statistics" chart, this reading turned out to be 0.6 percent. But, in fact, it is 3rd-order distortion that is most important in program reproduction from tape and in determining maximum tape output level or recording level. And in the case of the ZX tape used with the 680ZX deck at the 0 dB record level, that 3rd-order component is an incredibly low 0.2 percent.

Individual Comment by L.F.: I can recall, with some nostalgia, when I bought my Nakamichi 1000, a three-head stereo cassette deck introduced in 1972. Imagine being able to monitor while recording with cassettes! Or, even more remarkable, getting record/play response to 20 kHz and beyond, and transport motion with less than 0.1 percent wow-and-flutter!

Well, friends, Nakamichi—the acknowledged leader in cassette deck technology—has been regularly out-dogging its (and my) pride-and-joy with ever better performing decks. But as far as I am concerned, the new 680ZX offers greater value per dollar than anything Nakamichi has come up with before. Here is a deck that, at the push of a switch or two, actually aligns its completely separate record head so that it is parallel with the playback head for any given tape.

Essentially that's what the 680ZX offers over the 680 which was introduced a year or so earlier. Both models have bias and EQ settings for all sorts of tape,

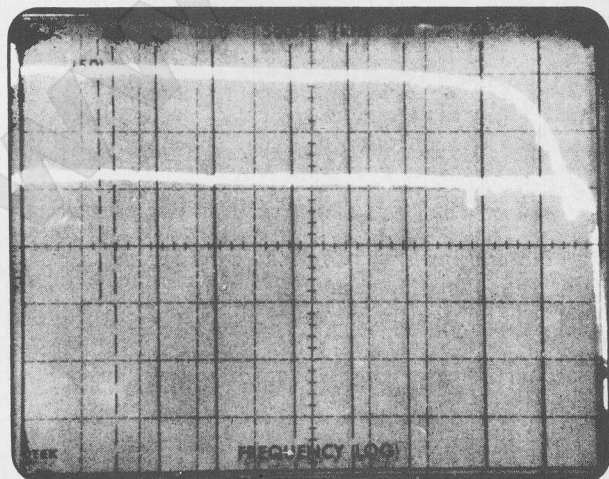


Fig. 5: Nakamichi 680-ZX: Record/play response at 0 dB & -20 dB record level, using Nakamichi metal tape ZX at half speed ($1\frac{5}{16}$).

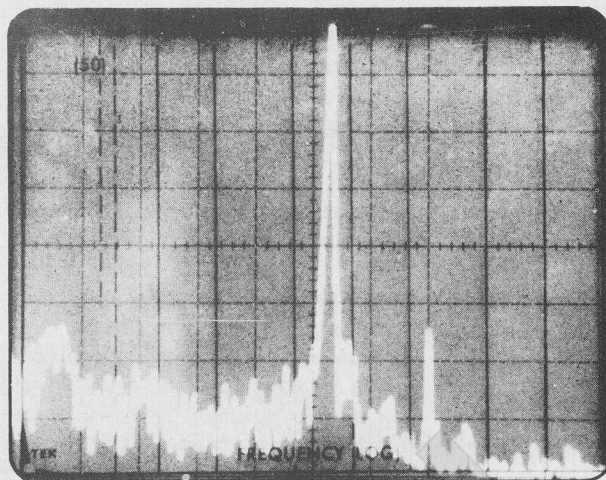


Fig. 6: Nakamichi 680-ZX: 3rd order harmonic distortion (peak at right half of display) is 54 dB below fundamental (center peak) for an equivalent percentage of 0.2%, using ZX (metal) tape recorded at 0 dB, 1 kHz signal.

including metal. While that may not seem like much of an accomplishment, I would hate to tell you how many manufacturers of cassette decks have "incorporated" metal tape handling capability that doesn't really show up the new pure metal alloy tapes to fullest advantages. As you can tell from our "Vital Statistics" chart, Nakamichi manages to extract every last ounce of performance out of every grade of tape used with the machine.

Not having had an opportunity to examine the earlier model 680, I was equally impressed with some of the special features carried over from that machine. Example: the Random Access Music Memory (RAMM) which, using the transport controls on the front panel, lets the machine count the pauses between selections, advancing or rewinding the tape to the selection of your choice. Example: the cueing mode which enables you to hear what is on the playback tape at high forward or rewind speeds without in any way injuring those playback head gaps.

Only Nakamichi would have bothered to provide six separate controls for record calibration (left and right channel adjustments for each of the three basic types of tape), and a calibration method that is so foolproof and easy to perform that you won't find yourself omitting this important step when making an important recording. There are, of course, twelve adjustments—that is, six for each speed. Which brings me to what is perhaps the most interesting feature of all: both the 680 and the 680ZX operate at $1\frac{5}{16}$ ips as well as at the standard speed of $1\frac{7}{8}$ ips.

Why did Nakamichi choose to go downward in speed when several competitors have begun to offer a higher ($3\frac{3}{4}$ ips) speed? According to Nakamichi, the technology of cassette recording has advanced so rapidly and to such a degree that it is now possible to obtain performance at $1\frac{5}{16}$ ips that was similar to the best performance obtainable at the higher standard speed of a few years ago. So, reasons Nakamichi, why not provide more recording time per tape (twice as much) when the material to be recorded is not super-critical. With the cost of metal tape being what it is, the use of this new tape becomes more reasonable at the slower speed. A C-45 becomes, in effect, a C-90. Nakamichi claims response to 15 kHz (for the -3 dB rolloff point) with metal tape at this incredibly low speed, and we did confirm the claim with two of the tapes we tested

(Nakamichi EX-II, and their metal alloy ZX tape). The SX tape (a cobalt-treated ferric-oxide formulation) got out to a very respectable 13 kHz for the -3 dB point.

Refer to the captioned photos for a closeup of that section of the panel that includes the feather-touch solenoid-control transport switches and the speed-selector knob. Also check out the closeup view of some of the toggle switches at the right of the intelligently laid-out panel. Note the separate EQ and Tape (bias) switches—a feature even my old 1000 didn't have.

There really is only one succinct way for me to sum up my reactions to this amazing machine from Nakamichi, and that is a simple question: Anybody out there want to buy my slightly used Model 1000?

Individual Comment by N.E.: Kudos to Nakamichi! Once again this manufacturer has come up with a genuine innovation in cassette recording that really pushes back the technological frontier, and advances the state of the art in a meaningful way. While other recent cassette decks may be noted for special features and ingenious twists, the model 680ZX is truly outstanding in demonstrating that a high level of both audio and mechanical performance can be achieved at half the tape speed of the existing format. This makes of the 680ZX not only a great piece of audio equipment, but something of an historic event no less noteworthy in its way than was the fabled model 1000 deck introduced eight years ago. One is tempted to suggest an analogy between the "half-speed" cassette and the long-playing disc, and the comparison does seem fairly valid. Here is a tape machine that provides twice as

much program time for a given length of tape and at a performance level that was considered satisfactory at the faster speed only a few years ago. As for the Nakamichi's performance at the standard speed, it is—as far as I can determine—unsurpassed by any other cassette deck I know of.

The model 680ZX is important in another, though related, way. For the first time, since Len and I have been evaluating this class of equipment, we have found a machine that really does justify the use of metal tape on all (not only one or two) counts—in terms, that is, of response, lowest distortion, best signal-to-noise and maximum headroom. Obviously, in grappling with the usual design trade-offs involved in tape-recorder design, Nakamichi engineers have emerged as the winners, so to speak, against the laws of physics.

While endowing this new machine with the alternate slow speed, and with the automatic azimuth alignment feature, the RAMM system, and some other desiderata, Nakamichi has deliberately omitted on-the-panel input mixing and for that matter, inputs for microphones. This doubtless has to do with keeping the deck's cost at a desired level, but it also relates to Nakamichi's design philosophy as exemplified in its "Black Box" line of "accessory components." These include, among other products, a microphone mixer with inputs for three mics. This device, in turn, relates to Nakamichi's idea of the tri-mic "live" recording setup which is explained in a booklet they have issued. So from this particular standpoint, the model 680ZX also represents a deliberately planned element in a larger overall recording philosophy.

NAKAMICHI 680ZX CASSETTE RECORDER: Vital Statistics

PERFORMANCE CHARACTERISTIC	MANUFACTURER'S SPEC	LAB MEASUREMENT
	At Standard Speed of 1 7/8 ips	
Frequency response, standard tape	± 3 dB, 10 Hz to 22 kHz	± 3 dB, 10 Hz to 23.5 kHz
high-bias tape	± 3 dB, 10 Hz to 22 kHz	± 3 dB, 10 Hz to 22 kHz
metal tape	± 3 dB, 10 Hz to 22 kHz	± 3 dB, 10 Hz to 23.5 kHz
THD at 0 dB		
standard, high-bias; metal	1%; 1%; 0.8%	0.75%; 0.8%; 0.6%
Record level for 3% THD		
standard; high-bias, metal	NA	+ 7.5 dB; + 8 dB; + 10 dB
S/N ratio, Dolby off		
standard, high-bias; metal	NA	57 dB; 59 dB; 61 dB
S/N ratio, Dolby on		
standard; high-bias; metal	NA; NA; 66 dB	66 dB; 68 dB; 70 dB
Wow-and-flutter (WRMS)	0.04%	0.04%
Speed accuracy	NA	+ 0.3%
	At Alternate Speed of 15/16 ips	
Frequency response, standard tape	NA	± 3 dB, 10 Hz to 15 kHz
high bias tape	NA	± 3 dB, 10 Hz to 13 kHz
metal tape	± 3 dB, 10 Hz to 15 kHz	± 3 dB, 10 Hz to 15.5 kHz
THD at 0 dB		
standard; high-bias; metal	NA; NA; 1.5%	1%; 1.3%; 0.8%
Record level for 3% THD		
standard; high bias; metal	NA	+ 3 dB; + 2.5 dB; + 5.5 dB
S/N ratio Dolby off		
standard; high-bias; metal	NA	54 dB; 54.5 dB; 57 dB
S/N ratio, Dolby on		
standard; high-bias; metal	NA; NA; 60 dB	63 dB; 63 dB; 66 dB
Wow-and-flutter (WRMS)	0.08%	0.07 %
Speed accuracy	NA	+ 0.3%
	At either speed	
Line input sensitivity	50 mV	50 mV
Line output level	1000 mV	950 mV
Headphone output level	600 mV (8 ohms)	570 mV
Fast-wind time, C-60	NA	58 seconds
Bias frequency	105 kHz	Confirmed

