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YAMAHA K-1020 CASSETTE DECK

Manufacturer's Specifications

Frequency Response: 20 Hz to 18 kHz; to 20 kHz with CrO₂ tape; to 23 kHz with metal tape.

Harmonic Distortion: 0.5%.

Signal/Noise Ratio: 59 dB; 75 dB with Dolby C NR, 95 dB with dbx NR.

Separation: 40 dB.

Crosstalk: 60 dB.

Input Sensitivity: Line, 40 mV.

Output Level: Line, 360 mV; head-
phone, 3.6 mW into 8 ohms.

Flutter: 0.03% wtd. rms, ±0.06%
wtd. peak.

Fast-Wind Time: 70 S for C-60 cas-
sette; 45 S in high-speed mode.

Dimensions: 17½ in. W x 5¼ in. H x
15 in. D (435 mm x 133 mm x 381
mm).

Weight: 16.8 lbs. (7.6 kg).

Price: \$599.

Company Address: 6660 Orange-
thorpe Ave., Buena Park, Cal.
90620.

For literature, circle No. 92



Sitting at the top of Yamaha's line of cassette decks is the K-1020, which has three heads for superior record/playback performance and a dual-capstan drive in a closed-loop configuration for stable, low-flutter tape transport. The record and play heads are made of pure Sendust, and the erase head is made of ion-plated ferrite.

The Yamaha deck is one of relatively few with Dolby HX Pro, which ensures the best possible headroom extension by dynamically controlling bias in response to the signal's spectral content. [See the article on HX Pro in August 1984 *Audio*, by Jensen and Pramanik, for more data.] This is not a noise-reduction system; however, the K-1020 does provide Dolby B and C NR as well as dbx NR, which gives it great flexibility in making recordings, and enables it to play back any prerecorded material. The K-1020 also has the unique ORBiT (Optimum Record Bias Tuning) system, which combines manual bias adjustment with a readout which shows when the bias is best for the tape being used.

The counter reads elapsed time from wherever it is reset. This is not a mere clock, which functions only in record and play modes; instead, it reads even in fast-wind modes, converting tape position into minutes and seconds via a computer chip. Such time indications are very useful when making recordings. The deck also offers memory and auto-play modes in conjunction with the counter. One handy feature is that the recorder will rewind and stop exactly where recording started if rewind is pushed during recording. This location is stored automatically, and the counter does not have to be reset first. Pressing and releasing the fast-forward or rewind button initiates normal fast winding, but holding down either fast-wind button raises the winding speed an additional 35%. This speed bonus is also available—and especially helpful—in auto-search mode, which finds the beginning or end of the piece being played. Fast-winding automatically slows near the tape's ends to prevent tape breakage.

The K-1020 features a fluorescent, peak-responding, wide-range stereo meter. Surrounding annunciators indicate monitor, memory and auto-mode status, tape type, whether recording is being done, NR system, multiplex filter, and bias-test status. These all make operation more convenient and help to minimize mistakes.

Control Layout

The K-1020's front panel helps make the deck easy to operate in most lighting conditions, not only because of its good displays but because its designations stand out in white against the black background. At the upper left of the panel is the large "Power" on/off switch. The "Eject" button, just below, is similar in shape, but because it's smaller and its surface is knurled, and because this layout is now common, users probably won't confuse them. There is a useful "Output Level" control further down, just above the "Phones" jack.

The cassette carrier tilts out briskly with a push of "Eject," but the stop is fairly gentle. Access for cleaning and demagnetizing is quite good, and with the door cover snapped off, it is excellent—among the best I've seen. The transport will not go into play mode without a cassette in place, so the deck won't rotate the pinch roller for you while you're clean-

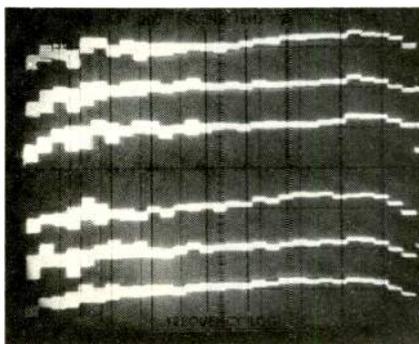


Fig. 1—Record/playback responses using Dolby C NR, at Dolby level (top three traces) and at -20 dB (bottom three traces), for Yamaha NR (Type I), Sony UCX-S (Type II) and Maxell MX (Type IV) tapes (top to bottom in each set). Vertical scale: 5 dB/div.

ing it. I would prefer to have the roller driven during cleaning, but it is true that, if it did rotate, a cotton swab could get wrapped around the capstan if you weren't careful. With a tape in place, tape slack is automatically taken up when the door is closed, and also when power is first turned on.

To the right of the cassette compartment is the "Master Fader," which is used only during recording. Yamaha recommends that this control be used just for fades from full-off to full-on, and for fade-outs; otherwise, they recommend leaving this vertical slider all the way up, at "0." A scale along the slider's left shows, in dB, how much the fader attenuates the stereo signal at various positions. (The controls which adjust individual-channel recording levels will be discussed a bit later.)

Across the top right side of the K-1020 is the display panel with the meters, counter and annunciators referred to earlier. At the left of this display is the four-digit elapsed-time counter, which has red LED numerals and a minus sign that lights if the tape is rewound past counter zero. The counter can be reset at any time, but it should, of course, be reset at the very beginning of a tape if you need to keep track of the *total* time (position) to any point on the tape. This counter has two valuable characteristics: It keeps its basic time calibration even with fast winding, and it maintains its reading (unless purposely reset) even when a cassette is ejected, so the user can note the time from the counter and write it on the cassette label.

The annunciators below the counter are "Rec" (which glows during record and record/pause modes and flickers when the auto rec mute is operating), "Test" (which lights when the ORBiT circuit is in use and flickers when ORBiT is in standby), and the "Tape/Source" indicator.

To the right is the memory-mode annunciator panel, with lights to indicate when the memory is in use and when either

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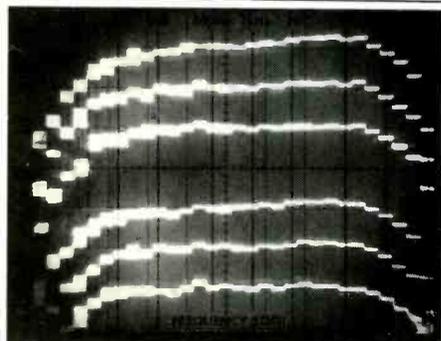


Fig. 2—Record/playback responses using dbx NR, with bias set with ORBiT circuit, at Dolby level (top three traces) and at -20 dB (bottom three traces), for same tapes as in Fig. 1. Vertical scale: 5 dB/div.

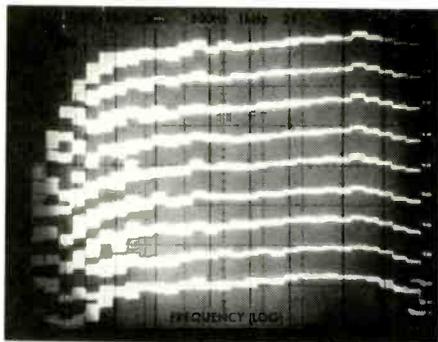


Fig. 3—Record/playback responses using dbx NR, with bias decreased slightly from amount set with ORBiT circuit, for Maxell MX (Type IV) tape. Dolby-level response is centered vertically, with responses measured from -16 to $+16$ dB. Vertical scale: 5 dB/div.

of the two repeat modes is active. One of these two modes, "0-M Repeat" (zero-to-memory repeat), plays the section of the tape between counter zero and any point the user enters into memory, up to eight times. The second, "Full Repeat," plays the entire side of the tape, then rewinds and replays it, also up to eight times. (That eight-time limit seems like more than enough to me!)

The recording-level meters are horizontal, fluorescent bar-graphs with a bluish-white center scale that extends from " -30 " to " $+20$." Little dot lights above and below these scale numbers serve as guidelines for maximum re-

cord levels; the dots extend to " $+6$ " for normal and chrome tape, and to " $+8$ " for metal tape—except when dbx NR is used, in which case the dots extend to " $+16$ " for all tape types. These guidelines are a good idea and are easy to read from any distance which would leave you within reach of the controls.

Segments light to show up to 18 different recording levels within the meter's range. (There are actually 19 segments, but the first, just to the left of " -30 ," is on all the time.) The meter segments covering the range up through "0" are bluish white, and the ones from "0" to " $+20$ " are red. The meters are classified as peak-responding, but confirmation of that was left to the actual testing. I found it slightly irksome that the single-digit scale numbers are just to the right of the corresponding scale segments, rather than centered on them. But in actual recording, where levels change rapidly, this objection proved trivial.

Below the bar-graphs, from left to right, are these annunciators: "Bias," with adjustment-direction arrows; "Filter"; symbols for Dolby B, Dolby C and dbx noise reduction, and indicators for "I/Norm," "II/CrO₂" and "IV/Metal" tape types. All of these annunciators are bluish white, except for "dbx," which is red in color.

Below the left portion of the display area, just to the right of the "Master Fader," are the transport control switches, all with good-sized, rectangular pushbuttons. Along the bottom, from left to right, are "Rec/Pause," "Stop" and "Mute/Search." Just above, from left to right, are rewind, "Play" and fast forward. Above these buttons are narrow-bar pushbuttons for "Reset," "Memory" and "Monitor." The functions of most of these are self-explanatory or have been mentioned before, but some additional comments are in order: Pushing "Rec/Pause" once readies the deck for recording, and recording is initiated by pushing "Play." A push of "Mute/Search" during recording will gain an automatic 4-S blank interval and a stop in "Rec/Pause." Holding the button in will get a longer blank time.

Holding in either of the fast-wind buttons gets a faster-than-normal winding. Pushing "Mute/Search" along with the wind button will get a fast rewind and a stop at the beginning of the present song; pushing "Mute/Search" with fast forward takes you quickly to the start of the next song. There are no status lights associated with any of the transport control buttons, but there is the red "Rec" annunciator that appears under the counter. A few simple checks showed that punch-in recording was possible from any mode as long as "Rec/Pause" and "Play" were both held in at the same time. This is a good feature, and I didn't see it mentioned in the manual.

To the right of the transport switches is a collection of controls, hidden behind a small swing-down panel. At the top, from left to right, are six pushbuttons, interlocked as needed, for "NR-Off," "Dolby B," "Dolby C," "dbx," "MPX Fil" and "Bias Test." All of the buttons are black, with the exception of "Bias Test," which is red. The designations above the buttons are hard to see when the deck is below eye level, but Yamaha comes to the rescue by printing a legend—quite easily seen—near the edge of the swing-down panel. As mentioned earlier, these buttons have associated annunciators in the display area.

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When "Bias Test" is pressed, the "Test" annunciator below the counter begins flashing; it lights steadily when "Rec/Pause" and "Play" are pressed to initiate recording of the test signal. When testing begins, the "Bias" annunciator below the record-level meter lights, with arrows showing which way to turn the "Bias Adjust" knob (just below the test switch) to set correct bias for the tape in use. When both the right- and left-pointing arrows are illuminated equally, bias is set correctly. When the "Bias Test" button is released, the tape is automatically rewound to the point where the test started. Overall, this is a simple and effective operation.

To the left of the "Bias Adjust" knob are the left and right "Preset Rec Level" pots with small, finely knurled knobs. Friction was not high, and adjustments were made easily. Further to the left is the "Auto Mode" rotary switch with positions for full repeat, zero-to-memory repeat, off, timer play, and timer record.

On the rear panel are the stereo input/output phono jacks, which are gold-plated, a nice touch. Also on the back is a DIN-type socket for the optional remote control.

Removing the top and side cover revealed a neat and well laid-out combination of p.c. boards. The main circuit board occupied more than half the chassis, and served as a motherboard for the smaller p.c. boards containing the Dolby and dbx NR circuitry. The power supply was on a separate board. The soldering was excellent; interconnections were made with multi-pin plugs. Adjustments were very clearly labelled, both with functions and with part numbers. The shielded, separately mounted transformer was just warm in operation. The transport looked good and was very quiet in operation. Overall, it was an impressive scene.

Measurements

Playback responses for both equalizations were excellent, with most points accurate to within a fraction of a dB. Meter indications for playback of a standard level were very close, within the limitations of segment resolution. Tape-play speed was just 0.1% fast. Record/playback responses were checked for a large number of tapes using pink noise, rolled off at 6 dB/octave above 2 kHz to make it more music-like. The adjustable bias permitted good matches to a large number of tapes. ORBIT (Optimum Record Bias Tuning) was very speedy in use and acceptably accurate, in general. (More on this later.)

Based upon the overall response curves obtained with the use of ORBIT, Yamaha NR (Type I), Sony UCX-S (Type II) and Maxell MX (Type IV) tapes were selected for the detailed tests to follow. Other very good performers were Fuji GT-I, Maxell XL I, and TDK AD for Type I; Denon HD7 and HD8, Fuji GT-II, Maxell XL II, Memorex CDX II, TDK HX-S, and Yamaha CR-X for Type II, and Scotch XSM, Sony Metal-ES, and TDK MA and MA-R for Type IV.

Figure 1 shows the record/playback responses for the three selected tapes at Dolby level and 20 dB lower, all with Dolby C NR. All of the responses are very good, even with the high-end roll-off at -20 dB and the slightly elevated responses from 2 to 10 kHz with Yamaha NR tape. Table I lists the -3 dB limits obtained using a sine-wave tone. Particularly noteworthy is the Dolby-level high-end limit of 20.2 kHz with Maxell MX and Dolby C NR. A slight decrease

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

Tape Type	With Dolby C NR				Without NR			
	Dolby Lvl		-20 dB		Dolby Lvl		-20 dB	
	Hz	kHz	Hz	kHz	Hz	kHz	Hz	kHz
Yamaha NR	16.3	10.2	15.5	16.5	16.2	8.7	15.5	18.6
Sony UCX-S	16.3	10.6	16.3	18.8	16.3	9.1	15.5	20.3
Maxell MX	17.1	20.2	17.4	19.8	17.2	14.2	16.0	22.2

Table II—Miscellaneous record/playback characteristics.

NR Type	Erasure At 100 Hz	Sep. At 1 kHz	Crosstalk At 1 kHz	10-kHz A/B Phase		MPX Filter At 19.00 kHz
				Error	Jitter	
Dolby C	62 dB	60 dB	-94 dB	50°	10°	-35.2 dB
dbx	87 dB	56 dB	-108 dB			

Table III—400-Hz HDL₃ (%) vs. output level (0 dB = 200 nWb/m).

Tape Type	NR	Output Level						HDL ₃ = 3%
		-10	-8	-4	0	+4	+8	
Yamaha NR	Dolby C	0.09	0.11	0.20	0.63	2.3		+4.7 dB
	dbx	0.07	0.09	0.10	0.14	0.22	0.45	+17.1 dB
Sony UCX-S	Dolby C	0.14	0.20	0.40	1.0	3.0		+4.0 dB
	dbx	0.16	0.19	0.24	0.34	0.45	0.75	+17.3 dB
Maxell MX	Dolby C	0.16	0.21	0.38	0.79	1.7		+6.4 dB
	dbx	0.15	0.19	0.24	0.32	0.42	0.60	+17.9 dB

in bias, below that which was set with ORBIT, raised the high-end limits but also added another 1 or 2 dB to the slight elevation which already existed in the 2- to 10-kHz region.

Figure 2 shows the record/playback responses for the same three tapes, using dbx NR and with the bias set using ORBIT. Results were disappointing, and a slight decrease in bias was made to reduce the high-end roll-off. (The low-end roll-off is characteristic of dbx NR, not restricted to the K-1020.) The reduction in roll-off was accompanied by some elevation in response from 2 to 10 kHz; some users might like this, others might not. The assessment: ORBIT did an excellent job of getting responses very close to the best possible, but minor bias trimming might be in order for the very most critical listening.

Table II lists record/playback test results, using both Dolby C and dbx NR. All of the figures are excellent, among the best ones I've seen to date. Note that use of dbx NR improves erasure and reduces crosstalk, albeit with some reduction in separation. There was some low-level bias in the output during recording.

Third-harmonic distortion of a 400-Hz tone was measured for the three tapes, both with Dolby C and with dbx NR. For these tests, the level was gradually increased from 10 dB below Dolby level to the point where HDL₃ reached 3%. The data in Table III shows low distortion at the lower levels for both NR systems, and also shows that a much higher maximum level is possible with dbx NR. Table IV lists the HDL₃ figures obtained with Maxell MX at -10 dB with Dolby C and dbx NR from 50 Hz to 5 kHz. The rise in distortion at the lower frequencies is much greater for dbx NR than it is for Dolby C NR. The distortion at the higher frequencies is

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Table IV—HDL₃ (%) vs. frequency at 10 dB below Dolby level.

Tape Type	NR	Frequency (Hz)						
		50	100	400	1k	2k	4k	5k
Maxell MX	Dolby C	0.32	0.36	0.16	0.15	0.14	0.27	0.29
	dbx	2.7	1.2	0.15	0.18	0.15	0.16	0.15

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

Tape Type	IEC A Wtd. (dBA)				CCIR/ARM (dB)			
	W/Dolby C NR		With dbx NR		W/Dolby C NR		With dbx NR	
	@ DL	HD=3%	@ DL	HD=3%	@ DL	HD=3%	@ DL	HD=3%
Yamaha NR	69.0	73.7	74.1	91.2	67.7	72.2	70.2	87.3
Sony UCX-S	72.0	76.0	78.7	96.0	71.9	75.9	74.5	91.8
Maxell MX	70.8	77.2	77.0	94.9	69.9	76.3	73.2	91.1

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	42 mV	>31 V	23	Line Hdphn.	340 mV 3.0 V	299 mV 0.67 V	1.6k 203	+21.8 dB

lower with dbx NR, but it is also low with Dolby C NR; all of the figures show the benefit of HX Pro, which is incorporated in this deck.

Signal-to-noise ratios were measured for the three tapes with Dolby C and dbx NR systems, using both IEC A and CCIR/ARM weightings. The results, shown in Table V, are all excellent, with Type II (UCX-S) figures superior to those for Type IV (MX) most of the time.

The input and output characteristics listed in Table VI are in general agreement with Yamaha's specifications, with some minor disparities. The headphone output, with an 8-ohm impedance instead of the more usual 50 ohms, delivered 2.1 mW per side. This was a bit less than specified, but maximum listening level at 0 dB was very high with all of the headphones tried, proving the value of the K-1020's output-level control.

The two sections of the master fader tracked each other within a dB at settings from full to 60 dB of attenuation, and most of the scale markings were accurate within a dB. This is excellent performance, and would enable you to make exact level shifts for both channels at once. The output-level control had more deviation between its sections—just over 1 dB at 20 dB of attenuation, and 2 dB at 40 dB down. The output polarity was the same as the input in "Source" mode, but was reversed in "Tape."

The frequency response of the bar-graph meters was approximately 3 dB down at 22 Hz and 21 kHz. The great majority of the meter scale calibrations were accurate to within a dB, including "-30" (-31 actual). From "-10" to "+4," errors were 0.6 dB at most. The meters' response time met the requirements for those classified as peak-responding, but the decay time of 0.87 S was short compared to the standard minimum of 1.4 S. Adding either a

positive or negative d.c. offset to the test tone burst did not raise the meter indication, which is as it should be for true peak-reading meters.

The average tape-play speed did not vary with changes in line voltage from 110 to 130 V. There were fairly regular short-term speed changes up to $\pm 0.015\%$ or so. Flutter was somewhat dependent upon the cassette used: It measured 0.045% wtd. rms and $\pm 0.065\%$ wtd. peak on the average, but just 0.025% wtd. rms and $\pm 0.045\%$ wtd. peak with the Yamaha NR tape. The fast-wind time for one side of a C-60 cassette was 68 S for normal fast wind, but only 48 S with the button held in for the higher speed. The time to change modes was 1 S or less.

Use and Listening Tests

The owner's manual presents considerable detail and good technical exposition on the K-1020's features, especially HX Pro and the Dolby and dbx NR systems. There are good illustrations and an excellent block schematic, helping to make it one of the better user manuals I've seen.

All of the controls and switches were completely reliable throughout the testing. The resistance to movement of the master fader's slider was high for fast fading, but the control's action was very smooth nonetheless. The right record-level pot knob was not snug on its shaft, but it never did come off.

I found ORBiT and the excellent metering and displays to be my favorite features, particularly when switching from tape to tape. I also found that I used the higher winding speed more than I thought I would. Timer start, mute, memory, and repeat modes all worked as they should. Going into record mode caused only a small click on the tape, down at the tape-noise level heard with Dolby C NR; I detected no sounds created by entering pause or stop modes.

Most of the listening tests were conducted using dbx-encoded discs from digital recordings, such as Rachmaninoff's Symphony No. 2 with the Scottish National Orchestra, Alexander Gibson conducting (Chandos ABRD 1021/dbx PS-1074). Switching to Dolby C NR made an obvious improvement in the noise level, but with Yamaha NR tape there was then too much added presence. With Sony UCX-S tape there was only a little additional presence, which was much more to my liking. Maxell MX was best of the tapes at the highest levels. With all three tapes, reducing bias slightly when using dbx NR improved the sound, to my ears. I still missed the deep bass of a number of LP sources, but there was no doubt about the K-1020's ability to record at very high levels with dbx NR. The elapsed-time readout was quite accurate, within 30 S over a 90-minute period.

The Yamaha K-1020 does not have a long list of special features, such as music programming, but it does have conveniences that are useful all of the time: Elapsed-time counter, ORBiT, wide-range metering, Dolby and dbx NR, master fader, output-level control, and extra-high-speed winding on demand. The internal construction is definitely above average, and its arrangement should minimize any required service time. The K-1020 offers a nice combination of features and performance for its price, and should compare favorably with other decks in its range.

Howard A. Roberson