

Tandberg 9000X Stereo Tape Deck



● THE Tandberg name has long been associated with single-motor tape decks, but the company's new Model 9000X departs from tradition by offering a three-motor transport that has a unique and highly sophisticated integrated-circuit (IC) logic control system. The 9000X is a three-speed ($7\frac{1}{2}$, $3\frac{3}{4}$, and $1\frac{1}{8}$ ips) machine with separate record and playback heads (and preamps) that permit off-the-tape monitoring. Like the other Tandberg recorders, this one uses a separate cross-field head to apply the recording bias to the tape. With this technique, relatively little high-frequency boost in the recording equalization is necessary (only 6 dB at 20,000 Hz and $7\frac{1}{2}$ ips). This means that there is a substantial improvement in recording "headroom" before signal saturation (overload) occurs. The capstan is driven by a hysteresis-synchronous motor, and separate motors are used for the tape hubs, which accept reels of up to 7 inches in diameter. A photoelectric system stops and disengages the transport at the end of a tape or at any point where a piece of clear leader tape has been spliced into the reel.

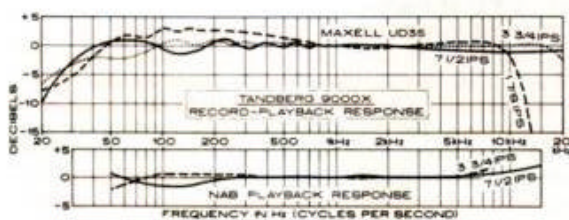
In the rear of the 9000X are the line inputs and outputs (and a DIN connector). Twin front-panel slider controls set recording levels, and another pair adjusts the playback-output levels. Signals applied to the two front-panel microphone jacks mix with the line inputs and share their level controls; there is no provision for separate adjustment of microphone levels. Microphones with rated impedances of 200 to 700 ohms can be used, and the input circuit automatically adjusts the preamplifier characteristics to suit the microphone impedance, maintaining an optimum signal-to-noise ratio.

During recording, the two level meters read the input recording levels, whether or not off-the-tape monitoring is used. When the PLAY button is pressed the meters are electrically switched to read the actual output levels under the control of the playback-level sliders. Meter circuits are designed to have the same response characteristics as the equalized signals fed to the tape head. This minimizes the possibility of tape saturation with high-frequency signals of the sort that conventional meters don't

respond to. In addition, the meters are fast-acting, reading the signal peaks within 40 to 50 milliseconds.

Below the meters are two red RECORD interlock buttons. Two other buttons (labeled SOURCE/TAPE) connect the line outputs to the program source or to the playback amplifiers. A small switch connects the playback from either channel to the other channel's recording input for making sound-on-sound or echo recordings. A headphone jack drives stereo phones with impedances ranging from 8 to 2,000 ohms.

The upper portion of the panel, finished in black like the lower control section, contains the reel hubs, a green pilot lamp for the power switch, and a four-digit index counter. At mid-height on the panel are the five feather-touch pushbutton transport controls, the power switch, and a tape-speed selector lever.



The logic-controlled tape transport system is one of the most fascinating features of the 9000X. Fifteen integrated circuits (equivalent to about seven hundred transistors!) are devoted to this function. The user can switch directly from any mode to any other, except that RECORD can only be engaged when the tape is stopped. For example, during fast forward and rewind, pressing the PLAY button stops the tape almost instantly, and in less than two seconds the transport resumes operation at the selected playing speed.

The RECORD function will not operate unless one or both of the interlock buttons is engaged. Since its action is virtually instantaneous, there is no need for the separate pause control found on most recorders. Once the input levels have been set, the 9000X is ready to record at the touch of a single button. If the PLAY button is touched while recording, the transport switches instantaneously from record to play (if the RECORD button is pressed while the tape is playing, nothing happens). Each button is illuminated in green (except for the red RECORD button) when activated; it is dark at all other times. The foolproof design of the 9000X transport, especially of its braking system, is illustrated by the fact that shutting off the power while the tape is in fast forward or rewind brings the machine to a smooth stop, with no tendency to spill or break tape.

The Tandberg 9000X is mounted on an attractive wooden base, and can be installed vertically or horizontally. Spring-loaded reel-lock hubs eliminate the need for

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rubber reel holders during vertical operation. Its panel dimensions are 16 $\frac{1}{8}$ inches by 15 $\frac{3}{4}$ inches; the deck is 7 inches deep and weighs 34 pounds. Price: \$649.50. An optional remote-control unit with special provisions to facilitate use of a timer costs \$79.90. Dynamic microphones are also available at \$49.80 each. A carrying case is \$40, and a dust cover costs \$12.

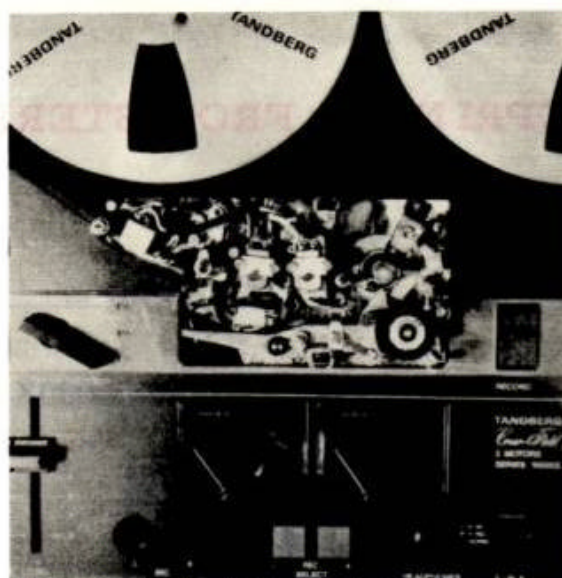
● **Laboratory Measurements.** The playback frequency response of the Tandberg 9000X, over the full range of the Ampex test tapes, was well within ± 2 dB from 50 to 7,500 Hz at 3 $\frac{3}{4}$ ips, and from 50 to 15,000 Hz at 7 $\frac{1}{2}$ ips. The record-playback frequency response, with the recommended Maxell UD35 tape, was typical of Tandberg machines: ± 1.5 dB from 30 to 25,500 Hz at 7 $\frac{1}{2}$ ips, ± 2 dB from 30 to 22,300 Hz at 3 $\frac{3}{4}$ ips, and ± 2 dB from 42 to 9,500 Hz at 1 $\frac{7}{8}$ ips.

An input of 110 millivolts (line) or 0.07 millivolt (microphone inputs, 600-ohm source impedance) produced a 0-VU recording level at 1,000 Hz. The corresponding maximum playback output level was 1.9 volts. These measurements were made in stereo; when only one of the channel recording interlock buttons is depressed, the gain is reduced by about 8 dB. Headphone listening volume was good.

The meters of the Tandberg 9000X are peak-indicating devices that read either -8 or -11 VU (depending on the tape speed) for levels that would produce a 0-VU reading on conventional meters. As a result, the 3 per cent reference-distortion point is reached at +2 VU on the meters at 7 $\frac{1}{2}$ ips. We measured slightly over 2 per cent distortion at Tandberg's 0-VU level at the two higher tape speeds, and 4.3 per cent at the 1 $\frac{7}{8}$ -ips speed. The 3 per cent distortion level corresponded to +1.5 VU at 3 $\frac{3}{4}$ ips and -2 VU at 1 $\frac{7}{8}$ ips.

Referred to the 3 per cent distortion levels, the unweighted signal-to-noise ratios were 70 dB at 7 $\frac{1}{2}$ ips, 66 dB at 3 $\frac{3}{4}$ ips, and 57 dB at 1 $\frac{7}{8}$ ips. These are equivalent to the best figures we have ever obtained on a consumer tape machine. The noise-level increase through the microphone inputs was not significant for any settings of the recording-level controls likely to be used. The gain of the microphone preamplifiers increases as the source impedance decreases, making the 9000X a good choice for making live recordings with high-quality, low-impedance microphones.

The wow was 0.025 per cent at the slowest tape speed and 0.01 per cent (the test tape residual) at the other



The erase head of the 9000X is located to the far left of the head nest. The record and cross-field bias heads—one facing the other—are directly above the left recording-level meter. The tape-drive mechanism is shown in the disengaged position.

speeds. Unweighted flutter was 0.075 per cent at 7 $\frac{1}{2}$ ips, 0.10 per cent at 3 $\frac{3}{4}$ ips, and 0.17 per cent at 1 $\frac{7}{8}$ ips. The tape speed, as determined by a stroboscope test wheel, was exact. A 1,200-foot reel of tape ran through in fast forward or rewind in 56 seconds.

● **Comment.** The performance of the Tandberg 9000X was as nearly ideal as any we have seen. Not only was there no audible change in the sound of records or FM broadcasts when recorded and played back at 7 $\frac{1}{2}$ or 3 $\frac{3}{4}$ ips, but even "pink" or random noise came through unmodified. This is an extremely severe test, particularly of a recorder's dynamic range at the highest audio frequencies. At 1 $\frac{7}{8}$ ips, the overall performance was quite close to that of a top-quality cassette recorder, and the usable signal-to-noise ratio was comparable to that of a Dolby-equipped cassette machine.

Because of the special meter calibration and response characteristics, recordings are made at a somewhat lower level than with most tape recorders. With average readings of about -10 VU, the full dynamic range of the machine is realized, and peaks to 0 VU or slightly higher do not cause significant distortion.

The transport controls operated smoothly and flawlessly during our tests and use of the recorder, and we had no problems in adjusting to their characteristics except for the close spacing (and identical size, shape, and color) of the four basic transport control buttons. Our only criticism (a minor one) of the functional electrical design of the 9000X relates to the lack of separate level controls for the microphone and line inputs. If you wish to use the mike inputs when the recorder is connected into a music system, it is necessary either to switch your amplifier to an unused input or disconnect the recorder's line-input plugs.

The tape-loading path is direct, essentially in a straight line, with a single tensioning arm adjacent to each reel. One-handed tape threading is not only possible, but practical. The Tandberg 9000X, which is priced only about \$100 higher than the manufacturer's best single-motor recorder, offers equal or better electrical performance in every respect, and essentially represents the current state of the art for consumer tape recorders.

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