



Tandberg Series 3000X Stereo Tape Deck

Maximum Reel Size: 7 in. **Speeds:** 7½, 3¾, and 1½ ips. **Heads:** Erase, Record, Crossfield Bias, and Playback. **Motor:** 4-pole induction (asynchronous). **Erase and Bias Frequency:** 85.5 kHz. **Inputs:** Mic, Line high and line low. **Frequency Response:** 40-20,000 Hz +2 dB at 7½ ips; 50-16,000 Hz +2 dB at 3¾ ips; 50-90,000 Hz +2 dB at 1½ ips. **Amplifier:** 50-18,000+3 dB. **Wow and Flutter:** Better than .07% at 7½ ips; better than 0.14% at 3¾ ips; better than 0.28% at 1½ ips. **Signal-to-Noise Ratio:** (7½ ips) 60 dB (weighted); 55 dB (unweighted). **Dimensions:** 15½" wide, 12¾" deep, 6½" high (over controls). **Weight:** 20 lbs. **Price:** \$299.00.

Several months ago (July, 1970), we profiled the Tandberg 6000 Series with the conclusion that it was the "top-of-the-line in the Tandberg tradition." Now comes the 3000 series, priced \$200 less than the 6000, but retaining practically all the performance of its bigger (in price) brother.

The principal differences between the two machines are that the 3000 is simplified, and does not have all the features of the 6000. For example, it does not accommodate magnetic cartridge inputs with suitable equalization. We do not consider this an important difference since anyone with a "system" would already have a "tape out" facility on his receiver or preamp. It does not permit mixing between microphone and line inputs; it does not accommodate a remote control; it uses an induction motor instead of a hysteresis synchronous drive; it does not incorporate a limiter, and it does not have a playback level control.

But, and it's a big but, it does give performance which is comparable with the 6000 model and at a price enough lower to attract many audiophiles who have always wanted a Tandberg, but couldn't quite fit one into their budget. Many of the features of the 6000 are undeniably desirable, but is a Cadillac always necessary when a Chevrolet will get you there just as well?

The two models are similar in appearance. At the top of the panel is the speed-control knob with its three positions that change equalization as you change speeds—the latter by raising or lowering a three-step pulley on the motor shaft. At the lower left are the two record-level controls, with meters above them. The meters are illuminated when recording on both channels, with only one being illuminated when recording on either channel separately. Next comes the head assembly, with easily removable covers for access to the heads for cleaning. A knurled wheel protrudes slightly from the front of the cover to permit listening to the tape while fast winding—it simply pushes the tape toward the playback head mechanically. Below the left end of the head cover are the two microphone jacks, and to their

right are the two record buttons for the individual channels. These buttons lock when depressed as the operating lever is put in the play mode, and if only one is depressed, the other is locked in the up position. The instantaneous start/stop knob is next, and next to it is the output selector with five positions: OFF, STEREO, LEFT, SOURCE, and RIGHT. The headphone jack is at the lower right corner of the panel.

Above this jack is the four-position operating lever. Pulled forward, the machine is in the play or record mode, depending on the position of the record buttons. To the right it is in fast forward and to the left it rewinds, with the center position being the rest. To facilitate threading, the lever has a fourth position upward—or backward, if the machine is in the horizontal position—which releases the reel spindles from the drive mechanism. On the rear panel are three pairs of phono jacks for low and high line inputs and for line output, a three-position sound-on-sound switch, and the line-cord input. The line is not fused, but there is an internal fuse in the secondary of the power transformer. The machine may be used in the horizontal position "as is," or in the vertical position with two plastic feet to stabilize the unit. These feet slip over the cabinet, and are attached permanently by two screws through the walnut-finished housing.

Circuit Description

Since no input mixing is involved, the three inputs all feed into the two-transistor mic/line amplifier, with the high-level inputs being fed through a 1-megohm resistor, the low-level line inputs through a 47 k ohm resistor, and the microphone inputs direct. The preamp is followed by the record-level control and a two-stage buffer amplifier which feeds the output selector and is connected to the sound-on-sound switch, as well as to the equalized record amplifier—a three-transistor section which feeds the record head from the output emitter follower, and also the one-transistor meter amplifier stage.

The equalized playback amplifier employs three transistors, followed by the output selector switch which feeds the two-transistor booster amplifier with the output from the second stage which is an emitter follower. The output feeds the headphone jack as well as the two phono output jacks.

The bias oscillator employs two transistors in a balanced push-pull arrangement, with the secondary of the oscillator transformer feeding a three-transistor amplifier ending in a complementary-symmetry output stage. The 6-volt 85-kHz output is resonated with a capacitor in series with the erase heads to put 90 volts across them, while the bias heads are fed from the same point through a bias-adjusting pot. The meter-illuminating lamps are fed from the d.c. supply to the bias oscillator so that they are lit whenever the bias oscillator is energized.

The power supply uses a bridge rectifier which furnishes 42 volts to a three-transistor d.c. voltage regulator which drops the supply to the amplifiers and the oscillator to 27 volts. The complete unit requires 34 transistors, six diodes, and one Zener. All three lamps—the two for the meters and one which illuminates the digital counter—operate from the 27-volt d.c. supply. When the deck is used in the vertical position, a formed metal plate covers the back—which is then the top—panel to provide a neat appearance. The primary of the power transformer is wound in two sections, permitting rewiring for operation on 220 volts as well as the customary 117 common in the continental U.S.A. To change to 50 Hz, the motor pulley must be replaced with another to maintain standard speeds.

Operation

The two line-input jacks—high and low—make it possible to record from a variety of sources. The high-level inputs are suitable for the usual output signals available from receivers or

tuners, while the low-level inputs can readily accommodate the "detector output" signals commonly available from European radio units. Record players with ceramic or crystal cartridges can be fed into the high line-input jacks since the input impedance—1 megohm—is high enough for such a source. When recording mono, the input amplifiers are connected in parallel so that either input jack can be used at will, with the channel on which the recording is being made selected by the proper record button. More about this later.

The head assembly consists of the erase head, the record head, the bias head (which is positioned directly opposite the record head at the back of the tape), and the play head. Between the record and play heads is a scrape-flutter filter roller, and a pressure pad provides sufficient drag on the tape to maintain good contact with the heads, which have no pressure pads against them. An automatic-stop provision in the tape path shuts off the motor when tape runs out.

The advantages of the crossfield head system of recording are fairly well known by now, but in any case it should suffice to know that better high-frequency response usually results from this method of applying bias.

While "mixing" between microphone and line sources in the same channel is not possible, it is possible to mix a microphone and a line source in mono, or to mix two line sources in mono. In fact, if an external mixer is used to mix the high and low line sources in each channel, four line sources can be recorded in mono. Similarly, one microphone and two pre-mixed line sources can be recorded, or two microphones can be mixed and recorded *in one channel*—not in stereo. In addition, either channel can be recorded on the other with the sound-on-sound switch, and a simulated echo may similarly be produced. On the whole, the Tandberg 3000 is quite a flexible machine in spite of its seeming simplification.

Performance

We made the usual performance tests on the deck, and found frequency response to be within specifications, as shown in Fig. 2. Distortion was found to be 0.5 per cent at indicated "0" level, rising to the 3-per cent point at +3.5 dB relative to the indicated zero. Signal-to-noise ratio was measured at 55 dB, unweighted, or 62 dB under the "A" weighting curve. Distortion at various frequencies was well under 1 per cent from 50 to 20,000 Hz at zero level. As is customary in Tandberg tape equipment, the meters indicate the actual signal being recorded *after* the high-frequency boost is applied. This may be disconcerting to anyone used to monitoring with a flat system, but it more definitely indicates the point at which distortion starts, which is the important reason for the level indicators anyhow.

Input signals of 205 mV and 9.4 mV are required respectively (at 1000 Hz) to obtain a "0" level with the record volume control at maximum; in the microphone position, the required signal was a low 0.2 mV. Line output level for a "0" recorded level at 1000 Hz was measured at 0.95 V. Microphone input impedance is 1000 ohms, suitable for better-quality mikes with impedances anywhere from 50 to 600 ohms. Bias/erase oscillator frequency was measured at 81 kHz.

Wow and flutter was measured at .06 per cent at 7½ ips, 0.12 per cent at 3¾, and 0.19 per cent at 1%, all below specifications. Fast rewind and fast forward times were found to be 125 seconds for 1800 feet of tape. The 3000 series is designed to be used with low-noise tape, and these measurements were all made with Scotch 203.

In trying the machine at various frequencies and voltages, we found that it ran 3 per cent slow at 90 volts, and that it wouldn't start at under 75 volts. Frequency changes did not affect the speed—only the variations in voltage.

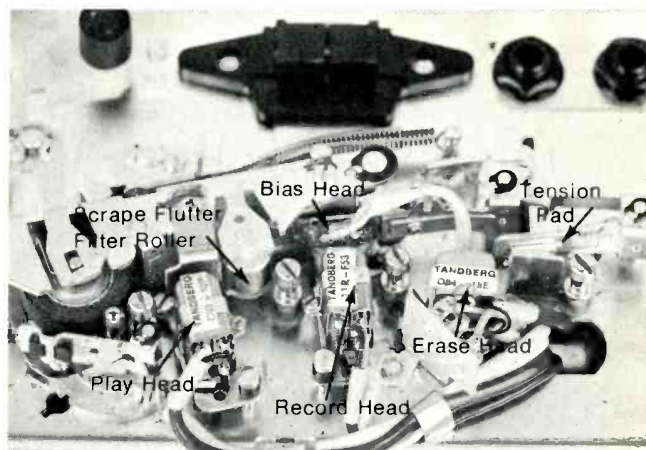


Fig. 1—Head assembly showing the scrape-flutter filter roller. Pad at left puts sufficient tension on tape to provide good head contact without the use of pressure pads on the heads.

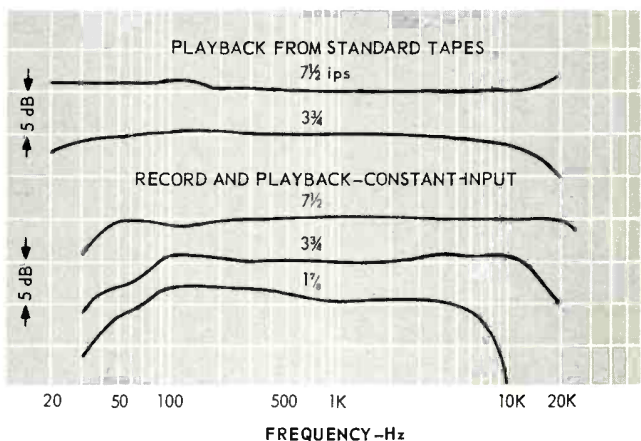


Fig. 2—Response curves.

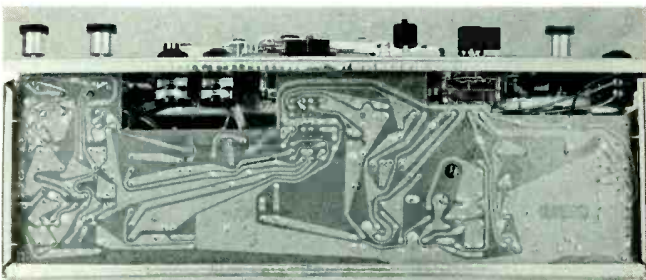


Fig. 3—Showing the foil side of the board containing mic/line amplifiers, buffer amplifiers, oscillator section, and d.c. voltage regulator. This board is covered by a shield and is mounted under the front edge of the chassis.

This is the first time, in our memory, that a Tandberg could be purchased at this low a price, but it appears that there has been no diminution in quality and that the buyer will have a fine instrument in this model. And because we did not consider it very important, we did not mention that the deck can be used as a preamplifier, just in case you should need one. This might work up into a PA system with the addition of a power amplifier. And you don't even have to use tape for this application.

C.G. McP.

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