

new equipment reports

THE CONSUMER'S GUIDE
TO HIGH FIDELITY EQUIPMENT

TANDBERGS, PLAIN AND FANCY

THE EQUIPMENT: Tandberg 6000X, a stereo tape deck (transport plus record/playback preamps) available in two versions: quarter-track as Model 6041X; half-track as Model 6021X. Dimensions in walnut case supplied: 15½ by 6½ by 12¾ inches. Price: \$499. Tandberg 3000X, similar deck with fewer features available in two versions: quarter-track as Model 3041X; half-track as Model 3021X. Dimensions: same as 6000X series. Price: \$299. Manufactured by Tandberg of Norway; U.S. branch, Tandberg of America, Inc., P.O. Box 171, 8 Third Ave., Pelham, N.Y. 10803.

COMMENT: The design problems posed by a high-quality tape deck for home use are exceedingly complex. Convenience, performance, cost, versatility, durability, and appearance all make stringent, and often mutually exclusive, demands. Want of careful planning on the part of the designer can result in a machine that functions admirably in some respects but lacks the concomitant features necessary for performance at a consistent level in related functions. At the other extreme are the relatively few machines that seem to be designed to a carefully thought-out chain of functional priorities, all geared to a certain spectrum of potential users.

The Tandberg 6000X is an example of the latter. Its priorities seem to have been thought out with unusual insight into the needs of home users who value versatility and sound quality above extreme convenience. Moreover it is a design one can grow into. While only the most casual of users should have any difficulty coping with its intricacies (and it contains some features that should be especially advantageous to those who are relatively inexperienced), it should also satisfy all but the audio perfectionist and the most special-interest oriented of advanced recordists.

A user who contemplates a great deal of tape editing, for example, might prefer a simpler head-cover design to facilitate marking the tape, though since tapes can be cued up easily on the 6000X it is more efficient for editing than most machines available to the consumer, including some models with features that purport to simplify tape editing. Likewise, the interconnections necessary for tape-echo effects take a little thought on the 6000X, though its system is basically simpler and more foolproof than the echo switching found on many home units, and it will produce the effect in stereo as well as mono recording, which many recorders with purely front-panel echo controls cannot. These (particularly the tape echo) are features that most users need only occasionally; quite



properly they are subordinated to the unit's main business: basic recording and playback.

Tandberg uses a hysteresis motor drive and four heads: erase, record bias ("crossfield"), record, and playback. The unit meets within normal tolerances, or, in some instances, exceeds by a considerable margin the specifications published for it. The lab data shown here must be approached with care in making comparisons to competitive equipment, however, because of Tandberg's special meter circuitry—actually one of the 6000X's most desirable features for the amateur user.

A true VU meter must conform to a carefully circumscribed set of mechanical and electrical parameters—which most meters on home recorders do not. In professional work the engineer must be able to "read" the meters in the same way no matter what equipment he is working with. Since pointer action that follows precise instantaneous signal levels would move too fast for visible evaluation, some compromise is necessary; and that compromise must be identical from one meter to another if the engineer is to evaluate the signal. But such standard VU meters require considerable experience for accurate signal evaluation, and they are not cheap. For home use a meter of less desirable characteristics but much lower cost has become the common norm.

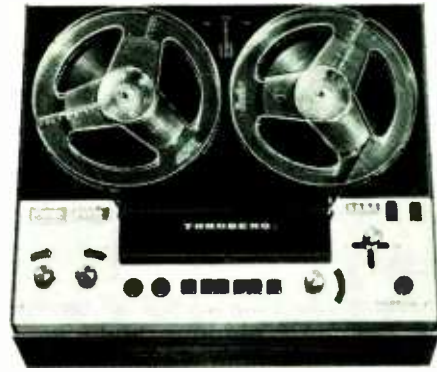
These so-called VU meters, however, are even more difficult to read accurately because of their uncertain ballistic characteristics. Moreover, there is no standardization among different models. The actual overload point (representing 3% harmonic distortion) can be anywhere from 3 to 15 dB above the 0-VU indication, and pointer response may either overshoot or fall short of actual values in response to sharp transients. Tandberg's solution to these problems is to build a meter that will respond to actual peak values within 50 milliseconds (gross distortion for shorter intervals generally is psychoacoustically imperceptible, according to Tandberg) and then linger at the peak

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value long enough for the eye to read it. The object is to do away with the protective "headroom" and the attendant guesswork built into conventional metering systems. At the same time, the meter is connected into the circuit after the signal is equalized (that is, after it has received the treble pre-emphasis that tends to make high-frequency peaks overload, more than low-frequency peaks of equal intensity), and its calibration is set so that the 0-VU point represents actual overload: approximately 3% harmonic distortion at any frequency.

The result is a metering system that, in our opinion, is unsurpassed in consumer tape equipment for simplicity and efficiency. If the user takes any care at all in the way he records his tapes, the metering should result in measurably, if not audibly, improved home-recorded tapes. Since a true standard 0-VU level reads -7 on the Tandberg meters, however, the process of measuring performance parameters in the 6000X is somewhat more complex than that for more conventional equipment. For this reason the resulting data are not strictly comparable in some respects. By way of generalized comparisons we would say that figures

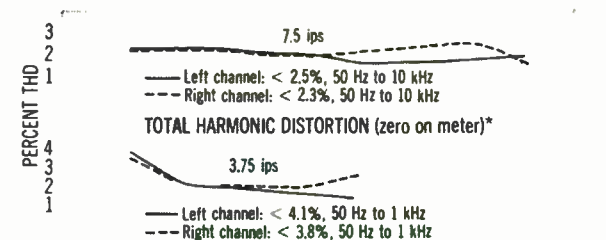
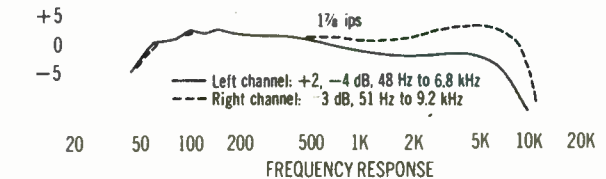
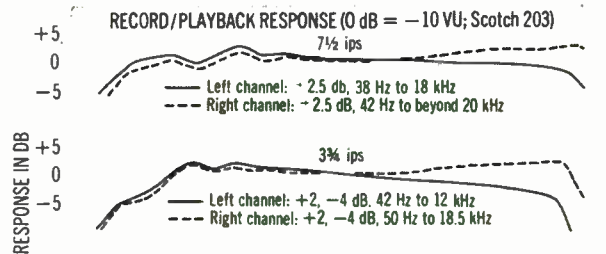
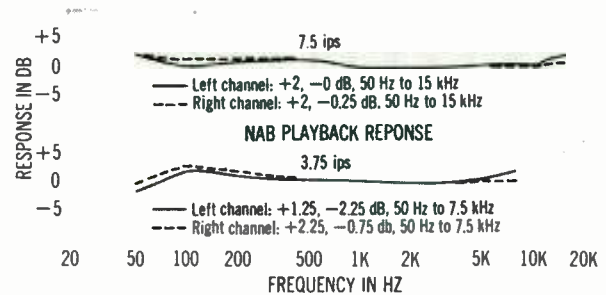


representing speed accuracy all are well within the pale for top-quality consumer equipment. While some imbalance between channels in the high-frequency end showed up during testing, it was not serious, and frequency response may be characterized as average to excellent. It is particularly good at the slower speeds, thanks presumably to the crossfield head. Noise and distortion are adequately low.

In addition to its metering system, the 6000X has a number of other unusual features: preamplified, equalized inputs for magnetic phono cartridges; inputs for ceramic cartridges; center-channel output; a really efficient "search" system; and a built-in limiter. The

Tandberg 6000X Additional Data

Speed accuracy, 7½ ips	105 VAC: 0.07% fast 120 VAC: 0.07% fast 127 VAC: 0.07% fast
3¾ ips	105 VAC: 0.30% fast 120 VAC: 0.30% fast 127 VAC: 0.30% fast
1⅞ ips	105 VAC: 0.60% fast 120 VAC: 0.60% fast 127 VAC: 0.60% fast
Wow and flutter, 7½ ips	playback: 0.05%
3¾ ips	record/playback: 0.07%
1⅞ ips	record/playback: 0.12%
Rewind time, 7-in., 1,800-ft. reel	2 min., 4 sec.
Fast-forward time, same reel	2 min., 0 sec.
S/N ratio (ref 0 VU, test tape)	playback record/playback
	l ch: 56 dB r ch: 56 dB l ch: 40 dB r ch: 36 dB
Erasure (400 Hz at normal level)	55 dB
Crosstalk (400 Hz)	record left, playback right record right, playback left
	50 dB 55 dB
Input sensitivity	
line, 0 VU record level	l ch: 2.0 mV r ch: 2.1 mV
0 meter record level	l ch: 3.9 mV r ch: 4.1 mV
mike, 0 VU	l ch: <0.1 mV r ch: <0.1 mV
0 meter	l ch: 0.13 mV r ch: 0.13 mV
magnetic phono, 0 VU	l ch: 0.47 mV r ch: 0.49 mV
0 meter	l ch: 0.90 mV r ch: 0.94 mV
ceramic phono, 0 VU	l ch: 3.3 mV r ch: 3.6 mV
0 meter	l ch: 6.4 mV r ch: 7.1 mV
Accuracy, built-in meters*	left: -7 (black) right: -7 (black)
IM distortion (record/play)	
7½ ips, -10 VU	record level
	l ch: 4.5% r ch: 3.9%
3¾ ips, -10 VU	l ch: 9.0% r ch: 10.2%
1⅞ ips, -10 VU	l ch: 12.0% r ch: 10.0%
Maximum output, 0 VU	l ch: 0.8 V r ch: 0.8 V
0 meter	l ch: 1.5 V r ch: 1.5 V
*Meters designed to read signal peaks rather than absolute VU levels. See text.	



* Tandberg recorder uses a peak-reading meter rather than a VU meter. Readings were taken at zero level on this meter. Scotch 203 tape.

phono inputs will appeal to users who mistrust extra connections and believe (justifiably) that every extra step in the path from disc pickup to tape record head can add noise or distortion to the dubbed signal. The center-channel output is intended primarily to add versatility to the possible monitoring connections. The search system permits audible output from the tape, even in the fast-wind modes, as an aid in locating a particular selection. Since it is spring-loaded, it returns automatically to silent fast-wind when not in use and discourages prolonged use (and the head magnetization that attends it).

The limiter struck us at first as an odd feature to include on a \$500 recorder. Surely anyone interested in this class of equipment knows that a limiter inhibits over-all sonic quality as well as signal overloads. Tandberg feels, however, that an inexperienced recordist—particularly when faced with a recording chore that will not allow him to set levels carefully in advance—will get a better recording of demanding program material with the limiter than he will without it. And after trying it we must agree. In one test we walked toward the microphones, clapping our hands at approximately one-second intervals. With the limiter turned off, the nearby handclaps pegged the meters. With the limiter on, the handclaps registered about -2

on the meters and showed some audible evidence of limiting, while the ambient noise in the room could be heard popping back in as the limiter's decay time was reached following each peak. But the effect was considerably less pronounced than it would be on most automatic-gain-control systems and was virtually inaudible in all but this worst-possible-case test.

The 6000X is a complex piece of equipment, to be sure. But its controls are so well thought out that their use is more self-evident and easier to master than those of many recorders that seem simpler at first glance.

The 3000X series is indeed simpler than the 6000X series and costs \$200 less. It is equipped with an induction (rather than hysteresis) motor, giving it somewhat less speed accuracy than the 6000X series; and inputs, controls, and outputs are all stripped down to straightforward basics. At the input end there is provision only for mike and line connections, and no mixing is possible in stereo. (Mike signals can be mixed with line or phono on the 6000X.) And the 3000X has no limiter circuitry. On the output end there is no metering, no center-channel output, and there are no level controls—which precludes sound-on-sound and tape-echo recording in stereo.

CIRCLE 145 ON READER-SERVICE CARD



A FINE-SOUNDING PICKUP FOR THE BUDGET-MINDED

THE EQUIPMENT: ADC 220X, a stereo phono cartridge with conical-tip (0.7-mil) stylus. Price: \$20. Manufacturer: Audio Dynamics Corp., Pickett District Road, New Milford, Conn. 06776.

COMMENT: ADC's lowest-priced magnetic pickup offers a level of performance that suggests a higher-priced model. Response is smooth and well balanced across the audio band, channel separation is more than adequate for the stereo effect, and the over-all reaction expressed by all who've heard the 220X's playing of musical recordings is one of "excellent reproduction."

A possible clue to the high-quality performance of this low-cost pickup is its compliance, notably higher than one would expect at the price: the lab measured 25 ($\times 10^{-6}$ cm/dyne) laterally and 22 vertically. It would seem that this excellent measurement compensates for a higher-than-average distortion measurement, and possibly too for the fact that the vertical angle measures 21 degrees, which is of course 6 degrees over the nominal 15. Be that as it may, the ADC 220X "listens" like a pickup with very little distortion.

The 220X is designed for tracking at stylus forces of 1 to 2.5 grams in any type of tone arm, including those found on average-grade changers. Tested in the SME arm, adjusted for antiskating and so on, the lab found that it needed 1.1 grams to track the most demanding test passages on CBS STR 120 and the glide tones on STR 100. Measured output voltage was 5.3 millivolts left channel, 4.8 millivolts right channel. A 1-kHz square-wave test showed a slight spike and some ringing which became damped before the cycle ended. If these characteristics seem about "normal" for a low-priced cartridge, certainly the plotted frequency response and channel separation

(in addition to the compliance mentioned before) are better than expected. As the accompanying graph shows, response is extremely linear and smooth from 30 Hz to 10 kHz, with a slight rise at the very low end (which, of course, reflects arm resonance as it does for any cartridge), and a more obvious peak near 20 kHz. This peak, often found in magnetic pickups, is "designed out" of the range more thoroughly only in the costliest of models; the fact that it doesn't appear more within the audible range in a unit priced at \$20 is noteworthy. The stereo separation, which runs at about 30 dB across the midrange and never reaches less than 20 dB across the entire audio band, is distinctly characteristic of the costliest pickups.

We'd say that the ADC 220X would be an excellent choice for upgrading an older stereo system, especially one that uses an older model changer. At the same time, this pickup can be installed by the budget-minded with no apologies in a late-model automatic or manual player.

CIRCLE 143 ON READER-SERVICE CARD

