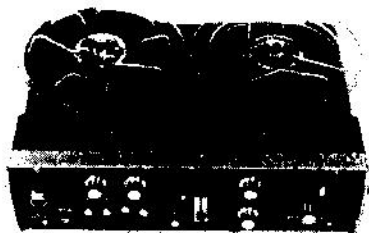


## TANDBERG MODEL 11 TAPE RECORDER



● For many years, virtually all new components coming to us for test have been stereo models. In the case of tape recorders, mono models are still very much on the scene, but they are almost never meant for serious listening or professional use. An impressive exception to this rule is the new Tandberg Model 11, a professional-quality portable mono reel-to-reel recorder.



The Model 11 is fully transistorized, and can be operated from a self-contained battery pack from which it draws 2 to 3 watts. If ordinary dry cells are used (ten 1.5-volt D cells are required), the battery life is about 5 to 6 hours in continuous operation, or about 20 hours if the machine is used half an hour per day. Rechargeable nickel-cadmium cells can also be used for long-term economy. For a.c.-line operation, Tandberg provides an optional battery eliminator that physically replaces the internal battery pack. It can also be used externally to recharge nickel-cadmium batteries in the recorder through an accessory connector. We tested the Model 11 with the a.c. power supply installed.

This is a half-track machine that takes 7-inch reels. It has three heads and separate recording and playback electronics for off-the-tape monitoring while recording. The microphone input, for a 200-ohm balanced dynamic microphone, uses a locking professional-type connector. Two line inputs are provided, for high- and low-level signals. Separate recording-level controls for the microphone and line inputs make it possible to mix signal sources.

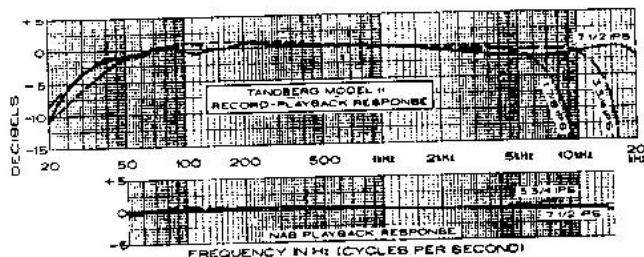
There are two playback outputs using miniature phone jacks. One is a monitoring output for 200-ohm unbalanced headphones; the other is a 600-ohm balanced output. Both are controlled by a single playback-level control. A small built-in speaker can be switched on to monitor either incoming or outgoing signals, but the line outputs are disconnected when the speaker is on. A meter indicates recording level, and when the PLAY button is depressed, it indicates the level at the line output. A battery-test button switches the meter to check the condition of the batteries.

The tape-transport control is a single lever that provides fast-forward and reverse when pushed right or left; normal speed is obtained by pushing it up. A separate recording-interlock button must be pressed simultaneously to record. The STOP lever starts and stops the tape instantly without causing the machine to switch out of the record mode.

The three operating speeds of 1 $\frac{7}{8}$ , 3 $\frac{3}{4}$ , and 7 $\frac{1}{2}$  ips are selected by a rotary switch that sets the unique electronic speed-control circuits of the Model 11. Precise and consistent speed is a necessity for professional applications, and since when operating on batteries there is no a.c. power line to establish the motor speed, a very effective electronic substitute was developed by Tandberg engineers.

*(Continued on page 44)*

A tachometer wheel on the capstan drive shaft generates an a.c. voltage in a special pickup head. This voltage is amplified, clipped, and then detected in a ratio detector whose d.c. output is proportional to the frequency or to the motor speed. The output of a separate 20-kHz square-wave generator is integrated to produce a triangular wave shape which is summed with the d.c. output of the ratio



detector. The summed voltage controls a Schmitt-trigger circuit, the output of which is a series of 20-kHz pulses whose width is a function of the motor speed. The average value of these pulses, after filtering, is a d.c. voltage whose value is a function of motor speed. After amplification, it drives the d.c.-operated capstan-drive motor.

This system maintains an extremely accurate motor speed, since any tendency for the speed to change produces a corresponding compensating change in the d.c. voltage that operates the motor. For speed change, the tuning of the ratio detector is changed, and the motor speed then changes accordingly to maintain a balanced condition.

We tested the Tandberg Model 11 with 3M type 150 tape, for which it had been adjusted. Its performance was well within specifications, and was of a fully professional caliber. At  $7\frac{1}{2}$  ips, the overall record-playback frequency response was  $\pm 1.5$  dB from 35 to 20,000 Hz, and the

NAB playback frequency response was  $\pm 0.5$  dB from 50 to 15,000 Hz. The unweighted signal-to-noise ratio was 60 dB. Wow and flutter were measured as 0.03 and 0.09 per cent, respectively.

At  $3\frac{3}{4}$  ips, the record-playback response was  $\pm 2.5$  dB from 30 to 12,500 Hz, and the NAB playback response was  $\pm 0.4$  dB from 50 to 7,500 Hz. The signal-to-noise ratio was 59 dB, and wow and flutter were 0.05 and 0.1 per cent. The  $1\frac{7}{8}$ -ips speed produced very listenable quality, although with a somewhat restricted frequency response of  $\pm 2$  dB from 40 to 6,500 Hz. The signal-to-noise ratio was about the same as it was for  $3\frac{3}{4}$  ips.

The HIGH line input required 0.12 volt, and the LOW required 3.4 millivolts for 0-dB recording level. At 0 dB, the overall distortion was 2.4 per cent, dropping to less than 1 per cent at -10 dB. The maximum line output before clipping was 3.3 volts. In wind and rewind, about 2 minutes were required to handle 1,200 feet of tape. The normal operating speeds were exact, as determined by a tape stroboscope.

The Model 11 is probably not for the casual hobbyist, but should be an excellent choice for recording interviews for broadcast (the built-in switchable automatic level control will be useful) or other field operations where the weight and bulk of conventional professional recorders would be prohibitive. Its performance, both mechanical and electrical, leaves nothing to be desired for such applications. The unit measures 4 x 10 x 13 inches and weighs 12.1 pounds with batteries.

The Tandberg Model 11 sells for \$449.50. A full-track unit and a pilot-tone version for motion-picture sound synchronizers are also available. The optional a.c. power supply is \$14.95, and a leather carrying case with shoulder strap is \$29.95.

**For more information, circle 158 on reader service card**