

# Tape Duplicating

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New consumer tape formats have placed formidable demands on commercially recorded tape duplicators. Here are Ampex's answers to the demands made by the Philips cassette system, and the constant clamor for higher quality in all formats.

**T**he proliferation of stereo tape playback configurations now being used by today's consumers—open reel, four and eight-track cartridge, and cassette—has brought about tremendous demands on tape duplicating engineers for faster and more sophisticated mastering and duplicating systems. These engineers are faced with such sticky problems as multiple channels on narrow-width tape and playback speeds as slow as 1-7/8 ips. Even the familiar four-track open-reel playback system is the object of further improvement in reproduction quality.

This all adds up to the fact that we are in a period of intense competition to develop further and perfect the art of tape mastering and duplicating so as to offer the consumer, no matter what his choice of tape system, a better product than ever before.

The newest medium on the scene requiring the attention of duplicating engineers is the mastering and duplicating of cassette stereo tapes. At Ampex the duplication of four tracks on 150-mil width tape posed some formidable problems for engineers whose goal was to produce

a high-quality sound from a tape that played back at 1-7/8 ips.

The new cassette duplicating system utilizes two Ampex 3300 master units at the head of each duplicating line, rather than the usual single unit. This permits continuous duplicating by eliminating the need to stop the slaves while the master tape is rewound. This dual mastering system lends itself especially to cassette duplicating because it gives a much higher production rate and eliminates the possibility of tape stretch during start and stop.

The reels of duplicated tape are 3,600 feet in length, hold up to 23 to 24 complete albums and can be duplicated on the tape on a continuous basis. Future use of larger reels of tape could produce as many as 50 albums on one reel.

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All four channels are mastered and duplicated simultaneously. Unlike open reel tapes, cassette tape channels are adjacent; channels 1 and 2, left to right, and 3 and 4 right to left. Stereo track widths are 0.024 inches wide.

A special tape duplicator was designed by the Ampex special products groups in Redwood City, California for use in cassette duplicating. This new slave, uniquely qualified to produce high-quality tapes in this narrow-width format, is a precision transport about the size of a portable closed-circuit video recorder.

Unlike any other slaves, these duplicators feature a tape tension control mechanism that prevents the tape from stretching when a change in mode is made. Dual capstan drive on these slaves virtually eliminates flutter and wow. Both of these features are prime requisites for quality tape reproduction at 1-7/8 ips. Also, a highly sophisticated guide system eliminates any tracking problems—a critical factor when recording four tracks on 150-mil width tape.

Another uniquely designed companion machine used for quality control checkout is similar to the duplicators but

Fig. 1. These two Ampex 3300 mastering units, using 1/2 inch tape, feed a line of ten cassette duplicators. Continuous tape duplicating is possible with the two masters operating alternately. All illustrations have been made at the Ampex facility in Elk Grove Village, Illinois.

Fig. 2. This line of ten cassette duplicators can produce as many as 10,000 albums a day if it is operated on an around-the-clock basis.



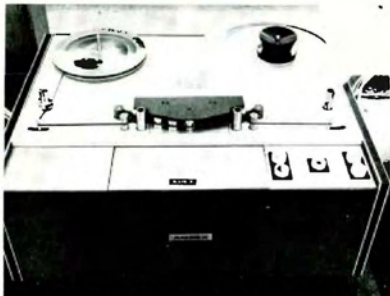


Fig. 3. This closeup of an individual cassette duplicator slave shows this specially designed product. Careful attention to tape tension control prevents tape stretch and a precise guide system eliminates tracking problems.

has two sets of heads, plus an automatic reversing mechanism. This allows complete auditing of cassette tape samples without the need for removing the reel and turning it over. Also featured is a motion sensor that preserves tape quality by completely stopping tape travel before reversing direction.

### Production

The new system masters at 120 ips on 1/2-inch tape while the duplicators operate at 30 ips. Because of its ability to duplicate a large number of albums at relatively high speeds, and a highly efficient system of tailoring the duplicates onto single-album hubs and placing them into their cassette cases, this system makes possible production of cassette stereo tapes at a rate of seven to eight times faster than ordinary open reel tapes. One line of 10 slaves with two masters can produce 10,000 cassette albums a day on a three-shift basis.

The stereo tape duplicating in Elk Grove Village, Illinois produces cassettes that offer a flat frequency response up to 15,000 cycles, which, while below the 15,000 cps attainable on 7-1/2 ips open reel tapes, does produce a high-quality sound.

The new cassette duplicating technique will be of special interest to sound engineers and commercial dubbing operators because the cassette concept itself is one that will be coming into widespread use in the very near future. Thought should be given to the use of proper equipment. In addition to large-scale music duplicating, there will be much small-lot duplicating for business firms to be used as sales tools and for schools as playback devices. There is already considerable interest in the concept on the part of the people who sell audio/visual equipment to schools.

### Lower Noise Duplication

In addition to developing systems that produce stereo tape duplicates in new configurations, Ampex sound engineers have come up with a new stereo tape mastering and duplicating process that substantially reduces background noise during tape playback that will be of interest to professional audio people.

Utilizing a new equalization curve the new system, which is being called EX+, permits up to a 100 per cent increase in the volume of the sound recorded on the master tape over standard recording techniques. The greater volume, which is passed on to the tape duplicate, reduces extraneous noise as much as 50 per cent, vastly improving the signal-to-noise ratio.

The EX+ recording technique is made possible by the elimination of the "safety zone" used in ordinary recording. The new equalization curve is monitored on a new highly sensitive meter coupled with new record and reproduce amplifiers, thus permitting maximum recording level. The safety zone heretofore had been maintained at approximately 6 dB below the distortion level which reached its maximum at an rms flex of 600 pico webers per millimeter of track width.

The result is a substantially louder signal recorded both onto the master and duplicate tapes while the background noise remains the same. All Ampex EX+ albums are recorded on polyester tape, virtually eliminating the possibility of breakage and prolonging head life.

The Ampex EX+ process is in many ways complementary to another recent development that represents the state of the art in tape duplicating. The new Dolby system is a highly effective means of reducing noise level from 10 to 15 dB at the point of original recording. This is accomplished by boosting or stretching low-level signals in four



Fig. 4. These tailoring machines take reels of duplicated albums and wind them onto individual hubs that will fit the cassettes. A sensing device activates a cutting mechanism that separates the individual album hubs of tape.

separate frequency ranges during recording and reducing or unstretching them on usable masters. Ampex has processed several Dolbyized masters for duplicating. And when combined with the EX+ process Dolbyized tapes produce a sound of great purity.

The technology of tape duplicating and mastering is moving fast. Small,

easy-to-use stereo cassettes operating at extremely slow speeds are producing sound quality that would never have been considered technically possible as recently as a few months ago. At the same time new techniques for open reel mastering and duplicating are making the purest form of music playback even better.

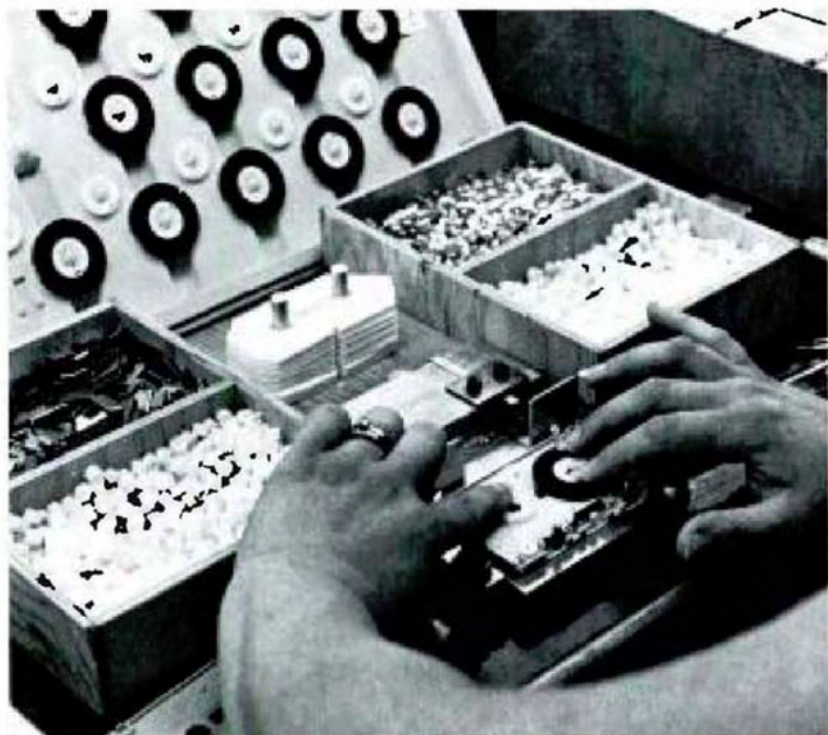


Fig. 5. The hubs of tape which have already been secured to a takeup hub by the tailoring machine, are inserted in the cassette casings prior to final sealing.