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Chapter 8 "Art of Digital Audio" Abstract

John Watkinson's topic for this chapter is the rotary-head recorder. Because of my mini-report investigation into the functioning of DAT recorders (particularly Tascam's high-resolution model), much of the material in this chapter was already familiar. The sections on the RDAT standard, DAT cassette type, and basic DAT operation were mostly review. With this chapter, therefore, I chose to focus on new areas, such as track following, shuttle mode syncing, and timecode in RDAT machines.

In any tape recorder, it is necessary for the information stored on tape (in the form of wavelengths) to be retrieved at the correct frequency and correct amplitude. The determining factor for reading the frequency of a recorded soundwave is tape speed, whereas head alignment affects the reading of amplitude. In order to ensure that a DAT player is reading the recorded wavelengths on the tape at the correct speed (and thus frequency), a pilot tone burst of 130 kHz is recorded at regular intervals throughout each track. By observing the rate at which these regular pilot tones pass by the playback heads, the DAT machine can tailor its playing speed to correctly match the speed at which the tape was recorded.

The method of aligning the heads with respect to the tape is also automatic and depends on these pilot tones. Since each track is recorded at an azimuth (diagonally with respect to the tape motion), tracks are recorded side by side. As a head reads one track, it has the possibility of picking up wavelengths from adjacent tracks in the form of crosstalk. As a rule, crosstalk is avoided. With track alignment, however, the effect of crosstalk is used to the machine's advantage. The playback head will pick up the frequencies of the pilot tones recorded on adjacent tracks due to the high level at which these pilot tones are recorded. If a head is in perfect alignment with the tape, the level of both pilot tones should be exactly the same as the head is equally far from the adjacent track. If, for example, the signal from a pilot tone on the track to the left of the one currently being read by the playback is stronger, the playback is obviously straying to the left and must be adjusted. Both this amplitude alignment and the previously discussed frequency alignment are solved by the pilot tones in the process known as area-divided track following (ATF).

Another form of DAT machines locking to tape concerns not regular speed playback but high speed shuttling. When the tape is shuttled, the track-following process breaks down and the heads cross tracks randomly. To combat this problem, DAT machines employ a replay head which is larger than the track width. This larger size allows the replay head to adequately scan quickly passing tracks even at high speeds. It is important for the DAT to shuttle information past the playback head at a constant speed so that replay circuits will stay in lock and be able to decode the tracks correctly. Sync blocs (like pilot tones) enable the DAT player to shuttle at these constant speeds. By doing so, subcode and timecode can be accurately recovered, thus facilitating the finding of pinpoint start locations.

This timecode on digital audio tapes can be recorded and independently edited after the audio recording has been made. In order to make this possible, subcode and timecode are stored outside the ATF patterns and are thus physically separate from PCM data. Subcode in RDAT has a similar function to track numbering on Compact Discs, storing start times, total times, and table of contents data. Timecode is recorded for more professional purposes, such as editing and synchronizing. The RDAT timecode is known as Professional Running Time (Pro R time). Similar to SMPTE, Pro R time allows DAT to lock with film, television, video, etc. Timecode is measured in the standard hours, minutes, seconds, and frames format. This timecode information, as well as the subcode data, is transmitted through the professional AES/EBU interface.