

CREATIVE RECORDING WITH 4-CHANNEL TAPE RECORDERS

*How to achieve special effects such as echo, reverb,
and balancing for stereo level and position.*

BY LEONARD FELDMAN

ACCORDING to several audio dealers surveyed recently, one of the hottest items in all of high-fidelity componentry is the 4-channel, open-reel tape deck. Of course, sales of these multi-track machines don't even come close to those of better stereo cassette decks, but when you consider the fact that reasonably good 4-channel decks sell for around \$600.00 and up, as opposed to Dolby-equipped cassette machines that can be had for as little as \$200.00 or sometimes less, consumer interest in the open-reel format seems unusual.

Add to this the fact that very few recording companies offer even a meager selection of pre-recorded 4-channel programming on open-reel tapes and the sudden interest in these expensive machines becomes even more puzzling. Surely, owners of 4-channel, open-reel decks are not spending that kind of money simply to transcribe their newly acquired CD-4 or matrix 4-channel records onto tape, although of course that is one application for these quadraphonic recorders.

A clue to the most popular usage of these machines was uncovered by further questioning of dealers and by thumbing through some of the recent product offerings from manufacturers who normally concentrate on such conventional products as tuners, amplifiers,

and receivers. They are now offering such "odd-ball" products as mixers and portable mixing consoles for consumer use. These include Shure, Teac, Sony, and others. Some of their mixers have six or more input channels and up to four output-channel facilities.

In addition, we found that microphone sales are better than ever at the consumer level, and we don't mean single microphone purchases to replace the original-equipment models supplied with cassette decks. We're talking about good dynamic and condenser microphones that sell from \$50.00 and up. These are finding their way into home hi-fi systems in increasing numbers, as are separate Dolby noise-reduction systems, compress-expand systems, and others. From all this sales activity, we concluded that the big 4-channel decks aren't necessarily being used to record or play 4-channel programming at all! They are forming the basis of thousands of "home recording studios," often capable of turning out master tapes that rival some of the products made by professional studios.

"Sel-Sync" Makes the Difference. At least five makes of multi-track tape decks sold to consumers have an important built-in feature that enables users to employ some of the same techniques used in recording popular music.

While just about any stereo or 4-channel deck is equipped with three tape heads (erase, record, and playback), the physical position of these heads in relation to tape travel is normally that shown in Fig. 1. The tape passes across the erase head first, where any previously recorded material is erased. Desired new program information is then recorded onto the tape as it passes in front of the record head and, a fraction of a second later, the newly recorded program can be "monitored" by the playback head and the playback preamplifier associated with that head.

This is a fine arrangement for making ordinary stereo or even 4-channel recordings, since it enables the operator to hear his recorded results (either via phones or through his speaker system) just a short time after the recording occurs. If he hears distortion, over-recording, or under-recording, he can correct control settings *almost* instantly. The delay is determined by the distance between the record and playback heads (in inches) divided by the tape speed (in inches-per-second). The faster the tape speed, the shorter the delay.

Suppose, however, that you wanted to record one tape track at a time, adding other tracks later. You might want to record the singing of a "one man quartet"—in which you or a talented friend provide all four harmonizing vocal parts

Pioneer's Model RT-2044 four-channel tape deck has "Synchronomonitor" mechanism for sound-on-sound and sound-with-sound.



by making four separate single-track recordings which you would later mix together. With the head arrangement shown in Fig. 1, there is no way in which you could record the second, third, and fourth tracks in perfect synchronism with the first recorded track. Even listening with phones (so that the previously recorded track would not be picked up by your "live" mike), your newly added vocal part would be applied to track 2 just a little too late and, if you listened to a playback of track 2 and tried to add the track-3 program, it would be farther behind and so on.

This is where the principle of "Sel-Sync" comes in. It's an abbreviation for selective synchronization. Sel-Sync is the tradename used by Ampex, the well-known maker of professional tape equipment. It arises from the need to hear previously recorded tracks while simultaneously recording another signal in synchronization with them on the same piece of tape. It is the principle of Sel-Sync which is involved in many of the modern recording procedures in studios around the country.

Contrary to popular belief, most contemporary recordings are not recordings of "live" musical events at all. Using as many as 16, 24, or even more tape tracks, recording engineers assign single instruments or voices to one or more of these tracks. Very often, individual tracks may be recorded at different times—even in different studios. A master recording will contain all of the individually recorded tracks and these are then "mixed down" by the recording en-

gineer, often with the aid of the producer and the artists themselves. It is during this mix-down process that individual tracks may be equalized ("sweetened" is the term used in the trade), augmented by echo or reverberation effects, rebalanced in terms of relative levels and positioned in the stereo or quadraphonic sound field. Sophisticated as these secondary steps may be, none of them would be possible were it not for Sel-Sync, which permitted the synchronization of all tracks in the first place.

How Sel-Sync Works: Although a record tape head is designed for optimum performance during its record function, there is really nothing to prevent one or more coils of the multi-track

head from being connected to playback electronics and used as a playback head. If the record head were designed to do its best job in the recording function, chances are it would not exhibit the greatest frequency response or signal-to-noise characteristics when used as a playback head. However, if the sole purpose of its transition to a playback head is to enable recording artists to synchronize their efforts with previously recorded tracks, fidelity of reproduction heard through the monitoring phones is not that important.

The principle of Sel-Sync is shown in Fig. 2. A single track (say, track 1) is recorded by the first program source. Recorders equipped with Sel-Sync will have a switch (usually a two-position slide switch) associated with each recording track. In the diagram, the switch is set to its normal or "record" position, thereby connecting the track-1 record coil and gap to the record electronics. After the tape is rewound, the track-1 Sel-Sync switch is moved to its alternate position, connecting the track-1 coil to the playback preamplifier. All other record tracks remain connected to their respective record electronics, so that any one of them can now be recorded while listening to the results recorded onto track 1.

This procedure can be repeated until all four tracks have been individually recorded. Any one of the successively recorded programs can be used as the "monitoring" channel, except, of course, the track currently being used for the new track then being "laid down." If desired, two previously recorded tracks may be monitored simultaneously while the third is being added, so that the performer can hear both earlier recorded



The Otari MX-5050-QXH has "Sel/Rep" for recording two discrete but time-synchronized tracks.

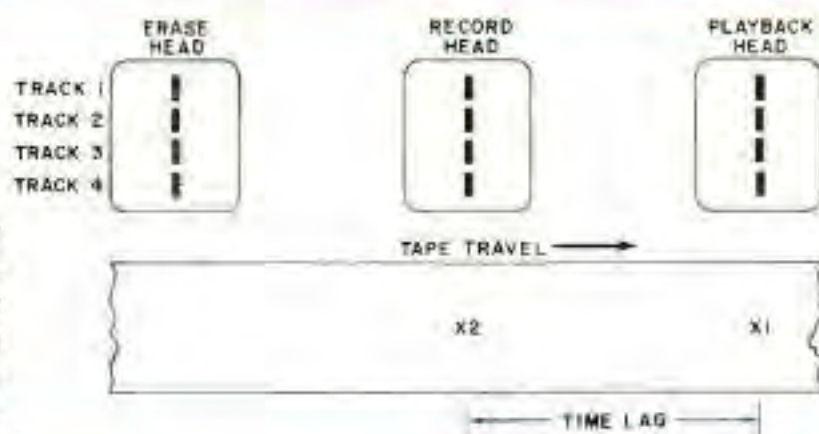


Fig. 1. If track 2 is recorded while listening to track 1's playback head, there is time lag between the programs.

tracks while adding his third track, and so forth. If there is acoustic isolation between the playback systems and the performing artist, monitoring can be done by the "home recording engineer" over speakers while the performer uses phones for the same purpose.

The possibilities are almost endless and, if you use your hi-fi component system for playback (assuming it's a 4-channel system for a quadrasonic mix attempt or a stereo system of a 2-channel mix-down) the tape output jacks of the receiver or amplifier can now be fed to a second deck (open-reel or cassette) onto which your properly mixed-down version of the recording can be recorded. It is at this point that mixers become most useful, since each of the four "raw" tracks can now be treated as a signal source into the mixer, which, depending on its flexibility and control features, becomes your home-recording console. Even without this addition, you'll find that 4-channel decks equipped with Sel-Sync also have individual level controls for each channel or track which enable you to balance relative levels before the final "master" mix-down or dubbing is made.

At least five manufacturers we know of have 4-channel open-reel decks

available that include the selective synchronization feature. Teac offers the feature, which it calls "Simul-Sync," on its Models 3340S and 2340R machines. The chief difference between the two is that the lower priced 2340R unit accepts 7" reels and operates at 3¾ and 7½-ips speeds, while the costlier version accepts 10" reels and operates at 7½ and

Model 1140, both with electronic echo, sound-on-sound, and sound-with-sound recording. Otari's MX-5050-QXH calls its version "SEL/REP," while Pioneer calls it "Synchomonitor." All of these machines have individual mike and line mixing controls for each channel, affording a great measure of flexibility even if a separate multi-channel mixer is not part of your home-recording set-up.

We visited a home-recording set-up which included a Teac 3340 and an Akai. With two decks, this enthusiast is able to do Sel-Sync recording of his masters and then transcribe the results, properly mixed and re-blended, to the second deck. The photos show close-ups of the Simul-Sync switches on the Teac machine and the equivalent push-button switches (one for each track) on the Akai unit.

Noise Reduction: A pair of Dolby noise-reduction units is used with these 4-channel decks. Why add Dolby to

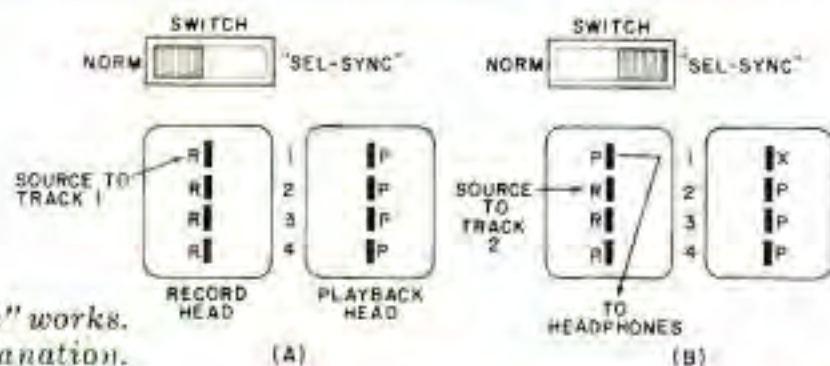


Fig. 2. How "Sel-Sync" works. See text for explanation.

15-ips tape speeds. In Akai's GX-630SS 4-channel deck, the feature is called "Quadra-Sync." This machine operates at two speeds and accepts large-size tape reels. Dokorder's synchronizing function is called "Multi-Sync," and is found on their 3¾-7½-ips, 7"-reel Model 7140 and their 7½-15-ips, 10½"-reel

such fine decks, each of which can easily produce a signal-to-noise ratio of 60 dB or more when used with quality tape? Simply because if you're going to do any dubbing (successive copying of tape-to-tape), each dubbing process will add a few dB of noise to the finished product, so you want to start out with every last



Closeup of "Simul-Sync" track switches on Teac 3340.



Akai "Quadra-Sync" track-selector buttons.

dB of signal-to-noise you can get. In this particular "home studio," the Dolby units are hooked up to the Teac deck, which serves as the master recorder. Dolby decoding is used during playback as the raw tracks are re-recorded onto the Akai machine, thereby affording more "head-room" to the finished mixed-down master tape.

Often the owner of this set-up has to transcribe his master tapes onto a cassette. To achieve best signal-to-noise ratio here, he uses a dbx Series 122 2-channel noise-reduction system. Working on a different principle from Dolby, this unit compresses the recorded material by 2 to 1 during recording and then, when the proper buttons are pushed, re-expands the program during playback by the same factor. The combined action increases the dynamic range by a wide margin while reducing noise and is especially useful with cassettes where over-recording or tape saturation is much more of a problem than with open-reel units.

Other Applications. You can simulate four-channel sound when recording two-channel (some old stereo tapes, perhaps) by returning the monitor output to the record head. In effect, you use the time delay between the playback and record heads to obtain an echo effect.

A tape technique that's mind-boggling is sound that circles the room. This can be accomplished with a "pan pot" to gradually move the sound from one channel to another. (Two Teac AX-10 stereo echo units make it easy to achieve such results, by the way. They enable a user to vary the degree of echo and incorporate impedance-matching networks.)

Having four independent channels at



Sony Model MX-510, a 5-input, 2-output mixer unit.

hand, all in perfect synchronization, offers new recording opportunities. From the standpoint of quality, it beats sound-on-sound since the former is a second-generation recording (recorded on the originally recorded track) with attendant fidelity losses, while a Sel-Sync deck can provide first-generation tapes. So now it's easy to make four independent recordings (actually you can make seven first-generation recordings by using mix-down techniques). What can you do with at least four tracks? For starters, one track can be used for voice, a second for background music, a third for special effects, a fourth for voice-over or another voice, perhaps singing or whatever else you choose. You're only limited by your imagination.

Isn't a Studio Cheaper? The equipment described here—which does not include any microphones or even the cassette machine used—adds up to nearly \$4000.00. The question naturally arises whether a serious recordist (or musical group, or singer, or instrumentalist) wouldn't be better off renting time at a professional recording studio. Well,

perhaps he would, but these days, studio time sells for upwards of \$100.00 an hour if you're talking about a top studio—and the hours have a way of ticking by as you wait for studio set-up, do several unsuccessful takes, wait for an acceptable mix-down, and the like. With so many aspiring groups around, it's not surprising that they opt for a home set-up not unlike the one described, for then they can afford to do as many "takes" as are necessary for a good "auditioning tape."

More than one successful recording group has used this approach to "breaking in" to the entertainment field, and stories of these successes have led other aspirants to make the investment in this kind of equipment. By way of comparison, even the relatively moderately priced mixing console manufactured by Tascam (the professional division of Teac), and considered to be the logical "bridge" between consumer equipment and truly professional studio console equipment, costs nearly \$2000.00 in its most elementary form. It can run several thousands more when equipped to maximum capacity, features, and number of input and output channels—and that's without considering even one tape deck or transport which would have to be used with the board.

Surprisingly, not everyone who owns the kind of equipment we have been discussing aspires toward producing a "golden record." Many are just seasoned audio enthusiasts who want the kind of recording flexibility and professionalism afforded by this kind of gear. Perhaps all they will record are "off-the-line" tapings of their favorite FM programs or dubbings from their favorite discs. But with imagination and good equipment, they can bring to bear an involvement and creativity that makes it all worthwhile and changes high fidelity from a passive hobby into a very active and exciting pastime. ○



Dokorder's 7140 2/4 channel deck with "Multi-Sync."