BRUCE BARTLETT

Recording Techniques

Make Cleaner Mixes With Midi Tape Sync

• In the songs you record, chances are you don't want to be limited to the sounds of a synthesizer, sampler and drum machine. You might want to use acoustic instruments and vocals as well. If you want to add a vocal or other microphone signal, you must record it on a multi-track tape recorder or in other words, you want to record part of your song in a sequencer and another part on a tape recorder. You need a way to make them both start together and run at the same tempo. This is done with a special sync tone that is recorded on one track of the multitrack tape recorder.

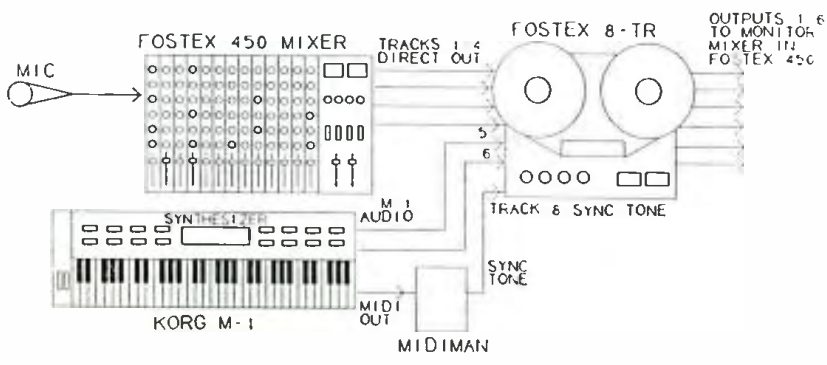
Start by recording synth and drum-machine parts with a sequencer. Next, record the sync tone on tape. After rewinding the tape to the beginning of the tone, start recording on tape. The sync tone makes the sequencer play. While listening to the sequencer playback, record vocals or acoustic instruments on tape. During mixdown, the tape plays back the audio signal of the vocals, while the sequencer plays back MIDI data that drives the synth and drum machine. The sync tone keeps the recorder and sequencer running together in synchronization. Usually, the sync tone comes from a tape-sync connector in your sequencer or MIDI interface. Run a special cable from the tape sync connector to the input and output connectors of one tape track.

Here's how it works: The MIDI clocks (timing pulses) from the sequencer are converted to a tape-sync tone which you record on tape. The tone shifts rapidly between two frequencies to convey the timing pulses. This signal is called FSK (Frequency Shift Keying). For more on the MIDI clock, please see the sidebar.

When you play the tape, the sync tone is converted back into clocks that the sequencer can lock to. The sync tone forces the virtual tracks to play in sync with the tape tracks. That is, the tone starts the sequencer playing at the beginning of the sequence, at whatever tempo is set in the sequencer. The sequencer then drives all the MIDI instruments at the same tempo.

If your sequencer lacks a tape-sync connector, you need a tape-sync box or tape synchronization adapter. Connect it between the sequencer's MIDI ports and one track of the tape recorder. This tape-sync unit is built into some recorder-mixers, such as the Tascam 644 and 688 Midistudios.

Figure 1. The recording setup.



TAPE-SYNC PROCEDURE

Let's say you want to record synth parts with a sequencer, then add a vocal on tape. Follow this procedure:

1. Record your sequencer tracks and set their tempo;
2. Record (stripe) a sync tone on one track of the recorder for the entire length of the song. This track is usually track 4 of a recorder-mixer with a sync input;
3. Rewind to the beginning of the tape tone, and set up the musician and microphone to record on another tape track;
4. While the tape is rolling to record the vocal, the sync track will start the synthesizer sequence at the proper time;
5. The vocalist listens to the synth playing and sings along while being recorded on an open track;
6. During mixdown, the sync track keeps the recorded voice track and live synth signals in synchronization. There's no need to record the synth signals onto multi-track tape — these signals just play "live" in real time along with the recorded vocal track. The result is a cleaner sound.

If you need more parts in your composition, you can record the synth parts onto tape, then overdub more synth parts in your sequencer. The sync track will keep them all synchronized. If your sequencer tracks have tempo changes, they will be followed if they were present when you recorded the sync tone.

SONG POSITION POINTER

What if you start the tape in the middle of a song — say, for overdubbing a solo? The sequencer will start from the beginning, instead of at the same point in the sequence, so you always have to rewind to the top of the song to keep the tape and sequencer running together. There is a

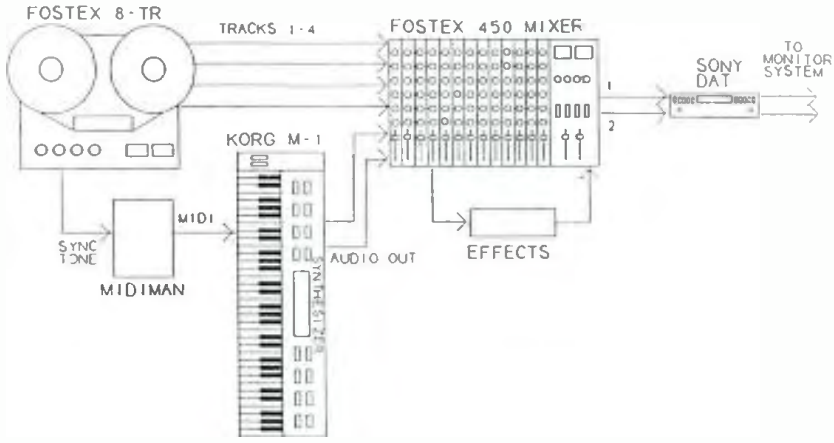


Figure 2. The setup for mixdown.

solution, however: Song Position Pointer (SPP).

The SPP tells the sequencer where to start playing. It specifies the bar and beat (to the nearest sixteenth note) from the beginning of the song. That is, it keeps track of how many sixteenth-note pulses elapsed from the start of a sequence. With the SPP feature, you don't have to keep going back to the top. You can start a tape anywhere in a song, and the sequencer will start at the corresponding point in the sequence (after a short delay).

To use SPP, you need a sync-to-tape converter with Song Position Pointer (also called smart tape sync). Some examples are the JL Cooper PPSI, Harmony Systems MTSI and Tascam MTS-30. With one of these units, tape tracks and virtual tracks can be synched anywhere in the song. This works only if your sequencer and synth implement the SPP — check your manuals.

A MIDI/TAPE SESSION

To illustrate how tape sync is used, I'll describe an actual home-recording session in which I used tape sync and DAT mastering. The sound quality you can achieve with these methods is outstanding. I hope you can learn from my mistakes as well as my successes!

The purpose of this session was to develop and record songs as entries for a songwriting contest. My friend Steve Mills assisted in the project. Tom Stewart, a local musician, composed each song in the form of a vocal with acoustic-guitar accompaniment.

Mills and I had to create a "backup band" with a synthesizer, record these parts with a sequencer, record vocals and guitars on tape and sync it all together. We used not only an analog tape recorder, but a MIDI sequencer and a DAT recorder (for mastering) as well. The recording required the following equipment:

- Musical workstation: Korg M-1 sample-playing synthesizer keyboard with a built-in 8-track sequencer;
- 8-track tape recorder: Fostex Model 80 with Dolby C;
- Mixer: Fostex 450;
- Microphones: Crown GLM-100 (guitars) and CM-200 (vocals).

We used the Korg M-1 to create the sounds of bass, drums and piano, and then recorded them with the Korg's internal sequencer. We recorded vocals, acoustic guitar and electric guitar on tape. The Korg's sequencer was synched to the tape tracks with a Musicsoft Midiman Midi-to-Tape Converter.

The Midiman is a smart tape-sync box that converts MIDI clocks with SPP to a tone you record on tape. But unlike other tape-sync boxes, it also lets you record sequences (MIDI performance data) on tape. This system costs less than a disk drive and allows more data storage than a RAM card.

Figure 1 shows the equipment setup for recording. From the Fostex mixer, direct outputs from input channels 1-4 went to the Fostex multi-track on tracks 1-4. The Korg M-1 audio outputs were recorded on tracks 5 and 6. Normally, the Korg audio outputs would not be recorded on tape until mixdown, but I wanted a tape backup in case the tape sync failed.

For monitoring, tape-track outputs 1-6 returned to the board's monitor mixer, which is the aux 2 bus. The Korg's MIDI OUT went to the Midiman's MIDI IN. The Midiman converted Korg sequencer data (including MIDI clocks) to a sync tone recorded on tape track 8. Track 7 was left blank and served as a guard track to prevent crosstalk to and from the sync-tone track.

PUTTING A SONG TOGETHER

Let's describe a typical composing/recording process for this session.

Now we were ready to add acoustic guitar. I stuck a GLM-100 mini omni condenser mic in a GLM-SM surface mount, and attached it with double-sided tape to the sound board of the guitar.

As Stewart sang and played guitar, I wrote down the chord changes and the tempo. We then set up the Korg to record bass on track 1 of its sequencer. While listening to the Korg's metronome, I recorded a 2-bar count-off of bass notes (1, 2, 3, 4, 1, 2, rest rest). Then, reading the chord changes, I played the root note of each chord as a reference by which to record other tracks.

I fluffed some notes and had to go back and punch in the correct ones, using the Korg's automatic punch in/out feature. I noted which measures needed correction, set the punch points to those measure numbers and re-recorded the bass part for those measures.

When the bass track was done, I set the Korg's patch to drums and labeled the Korg keyboard with tape to indicate which keys played which drums. Next I recorded a 2-bar drum pattern. Then, on sequencer track 2, I made the pattern repeat for the length of the song. Now we had two basic tracks of bass and drums. I set the Korg to record on track 3, and switched to a bass patch. While listening to bass and drums, I added bass fills on track 3.

I recorded drum fills (such as a cymbal crash at the beginning of each chorus) on sequencer track 4.

The synthesized parts of the song were done.

ACOUSTIC OVERDUBS

Now we were ready to add acoustic guitar. I stuck a GLM-100 mini omni condenser mic in a GLM-SM surface mount and attached it with double-sided tape to the sound board of the guitar. A natural-sounding mic placement was halfway between the sound hole and the bridge, near the low-E string.

Wearing headphones, Stewart listened to a monitor mix consisting of his acoustic guitar and the Korg tracks. He played along with the Korg tracks to practice his part. When we were ready to record his overdub on tape, I hit "record", pressed the *write* button on the Midiman to start the sync tone and pressed the *play* button on the Korg to start its sequence.

Normally you record the sync track first, then go back and record other tape tracks. This is because you might lose sync if you record the sync track and other tracks at the same time. In this case, we were able to record them simultaneously without losing sync.

A sync tone must be recorded nonstop for the entire length of the song. Even though Stewart made some mistakes playing his guitar part, we kept going to the end. We later punched-in to correct errors.

Finally we added the lead vocal. A Crown CM-200 cardioid condenser mic with a foam windscreen was placed about eight inches from the singer, at eye height aiming at the mouth to prevent breath pops. Harmony vocals were recorded after several practices.

Mills overdubbed electric lead guitar on one song. His guitar amp was mic'd with a Crown GLM-100 mini omni microphone taped to the amp's grillecloth. On another song, Stewart wanted to add a bass track with the Korg, which contained only a drum track in its sequencer. I couldn't record a bass track in the Korg's sequencer in sync with the tape track. That is, while the Korg sequencer was recording a bass part on an open track, it did not sync properly with the prerecorded tape tracks. Normally I could listen to the Korg drum track by itself and overdub bass, but I needed the tape tracks for musical cueing. It's best to start with a simple bass line in the sequencer so you have something to cue to later.

Another thing I found useful was to note the measure numbers for the main sections of each song: verse 1, chorus 1, verse 2, chorus 2, etc. Knowing these numbers made it easy to go directly to the part needing work.

One song ended in a ritard. Stewart had difficulty following the ritard originally programmed into the Korg, so we decided to stop the Korg tracks when the ritard started, and have it played by the acoustic guitar. To stop the Korg, I simply erased the sync tone from where the ritard began. The Korg sequencer stopped playing at that point.

Most of the songs synched properly: the beat of the tape tracks matched that of the sequencer tracks, but one song did not sync.

After we finished recording one song on tape, we discovered that it was too long, and we wanted to edit out 8 bars. Using a splicing block and a razor blade, I removed the appropriate section from the multi-track tape. I then realized I had also edited the sync track. Would the Korg stay in sync? Sure enough, it did. However, I don't recommend this procedure for an FSK sync track. Normally you would perform such an edit on the 2-track mix tape, but we planned to master to DAT, which doesn't permit such editing.

Several times throughout the session we were treated to a MIDI surprise: a drum-track performance was played by a bass patch instead, or a piano-track performance was played by drums. It was an interesting effect, but not what we wanted. To solve it, Mills suggested I pull the MIDI cable from the Korg's MIDI *in* port. That worked. The sync track had been driving the Korg set to whatever patch I was working with. I also made sure the correct patches were assigned.

MIXDOWN

With all the songs in final form, we were ready for mixdown. The mixdown setup is shown in *Figure 2*. Tape track 8 containing the sync tone fed the Midiman, which converted the sync tone into MIDI to drive the Korg's sequencer. The Korg's stereo audio outputs were fed into the Fostex 450 mixer, along with tape tracks 1-4 (the acoustic overdubs).

So we had a 6-track mix: four tape tracks and two Korg audio signals. Those two Korg signals were a mix of up to four sequencer tracks. The output of the mixer fed a Sony DAT recorder.

I set the multi-track tape in *play* mode. The sync tone started the Korg and activated its sound generators. I had set the Korg's sequencer to external clock, thinking that was the correct way to activate it from the sync track. But I heard a double performance — two versions of the same song playing on top of each other, slightly delayed. Each time I stopped and restarted the tape, the delay changed. The Korg was trying to play both the external sequence (recorded in the tape-sync tone) and its internal sequence (recorded in its built-in sequencer). Setting the Korg to internal clock solved the problem.

Normally you would set a sequencer to external clock to drive it from an external MIDI clock from an FSK sync track, but the Midiman's tape-sync signal already had sequence data in it. I set the Korg to internal clock, and it played only the sequence recorded on tape.

Most of the songs synched properly: the beat of the tape tracks matched that of the sequencer tracks, but one song did not sync. The cause might have been dropouts in the sync track (I saw dropouts of up to 4 dB on the level meters), or I may have started the sync tone before the recorder was up to speed. I was glad we had recorded the Korg performance on tape; these tracks were used in the mix of this song.

In the rest of the songs, however, the Korg tracks played live-to-DAT during the mixdown. The multi-track parts were heard virtually first generation, since the DAT did not degrade their signals. The resulting mix was super clean. For slap echo and reverberation, we used an Alesis Midiverb II and a Microverb. They really added a professional finish to the production.

After recording a mix on the DAT, I hit stop on the DAT machine. Next, I set up the mix for the next song. Then I set the DAT in record and pause mode, played the multi-track

tape and started the DAT just after the count-off. The entire group of five songs was assemble-edited this way. The DAT put slight noises between cuts, but they were hardly audible. From the DAT master tape we made cassette copies.

It was fun learning the new technology and getting the bugs out. The end result was the cleanest mix we have made to date, and you can expect the same results with similar equipment. Now we just hope that Mills wins the songwriting contest!

SIDEBAR: THE MIDI CLOCK

• Think of your MIDI instruments as a band of musicians; you want them to start playing at the same time and at the same tempo. To do this, they need to see a signal that is like a conductor's baton movements. This signal is the MIDI clock.

The MIDI clock is a series of timing pulses in the MIDI signal. A clock is a single-byte message that occurs 24 times for each quarter note. That is, the standard clock rate is 24 pulses per quarter note (24 ppq). Each MIDI note or event is time-stamped with a pulse timing reference.

The clock generates pulses at a high rate (24 ppq) to provide good resolution of the time value of each note or event. The 24 ppq standard can resolve sixty-fourth-note triplets, which occur every pulse.

When a MIDI instrument receives a series of clock bytes, it knows the desired tempo. For example, if a sequencer drives several MIDI instruments at a certain tempo, its clock forces all the MIDI instruments to play at the same rate.

If you want to synchronize MIDI equipment with a tape recorder, you need to record a form of MIDI clock pulses on tape. As the article mentioned, this is done with a special sync tone that you record on one track of your multi-track tape recorder. db