Reviews: Ensoniq EPS 16 Plus, Yamaha TG33, Digidesign SampleCell and more

Electronic Musician

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April 1991

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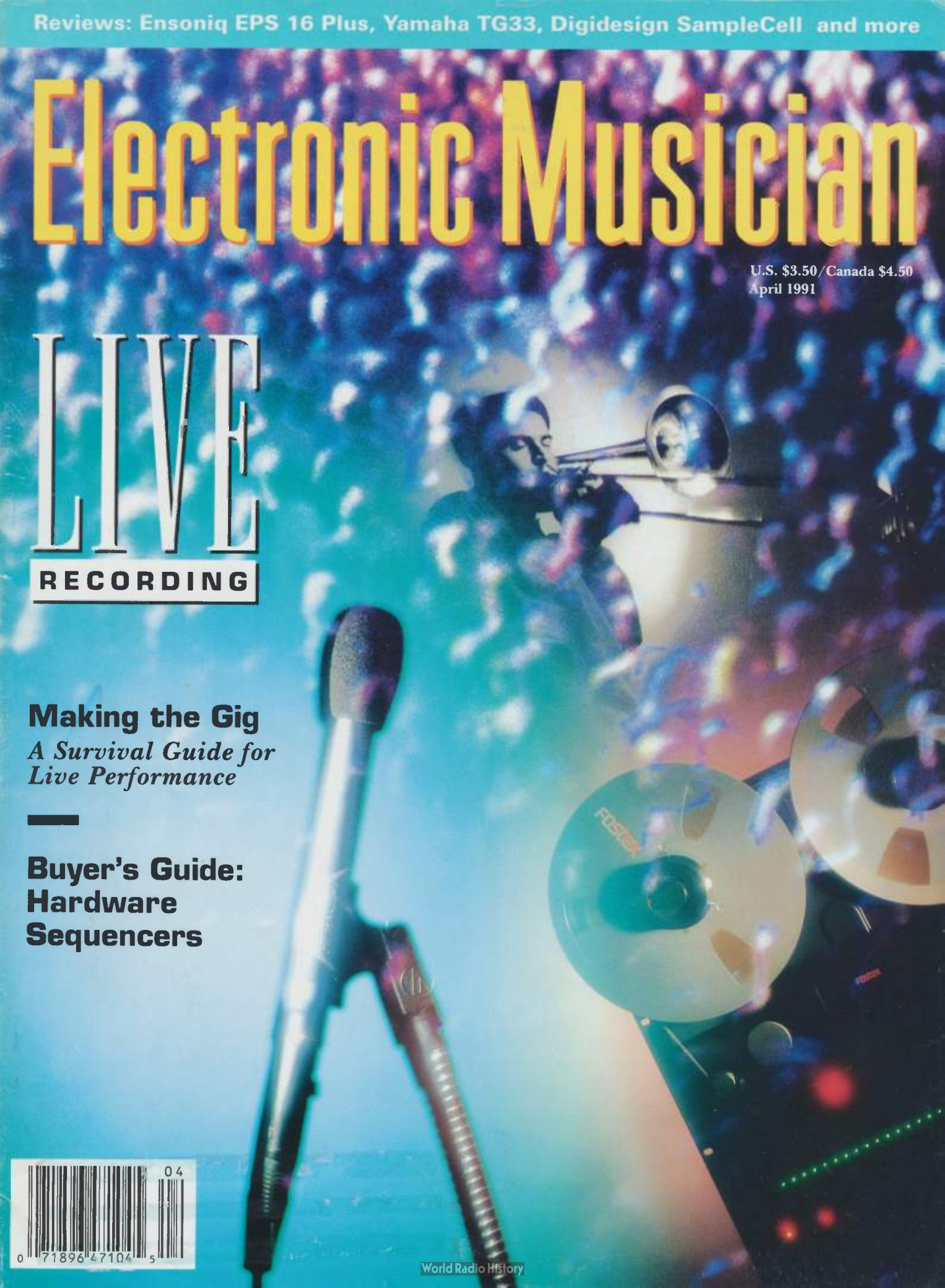

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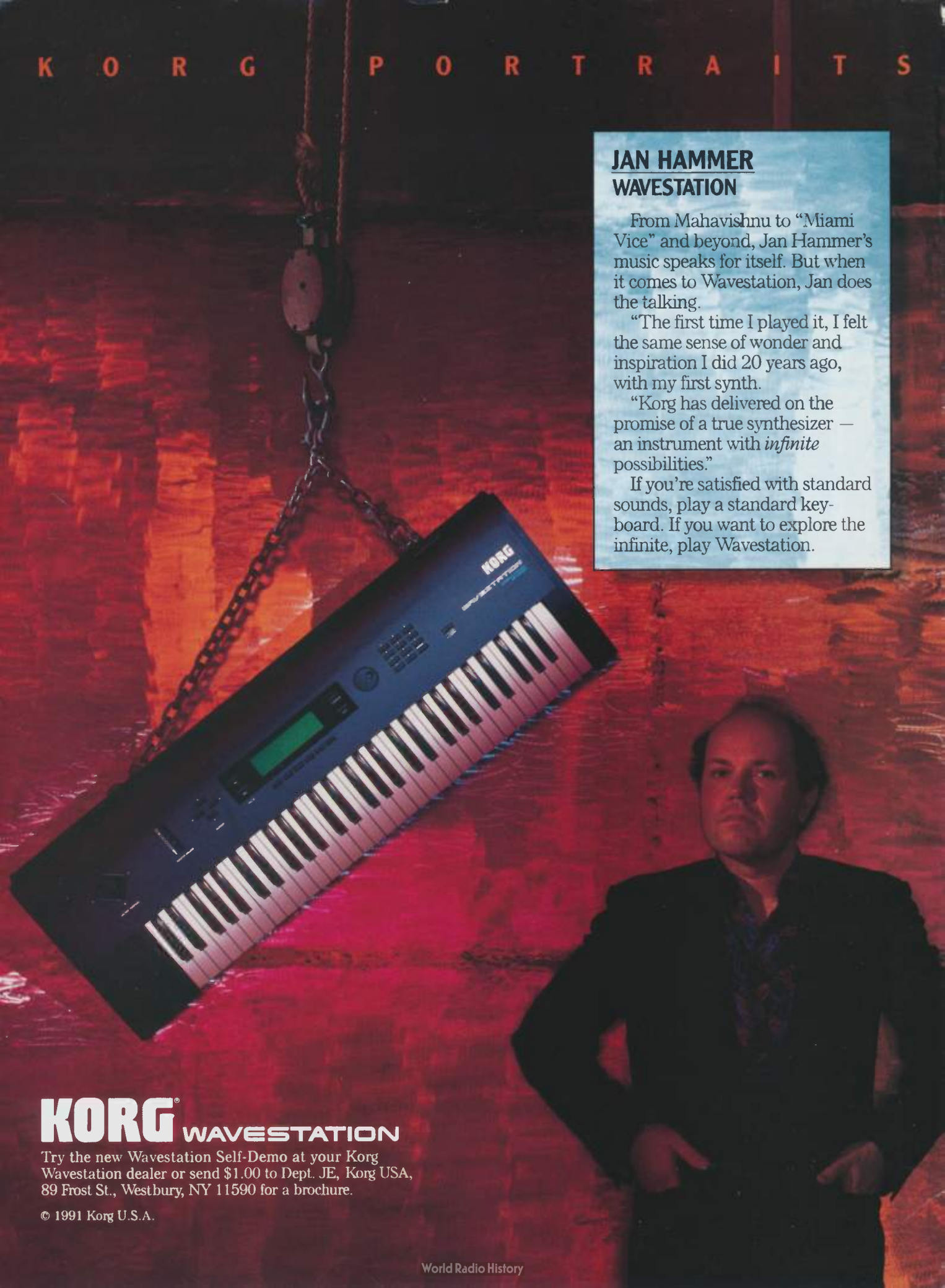

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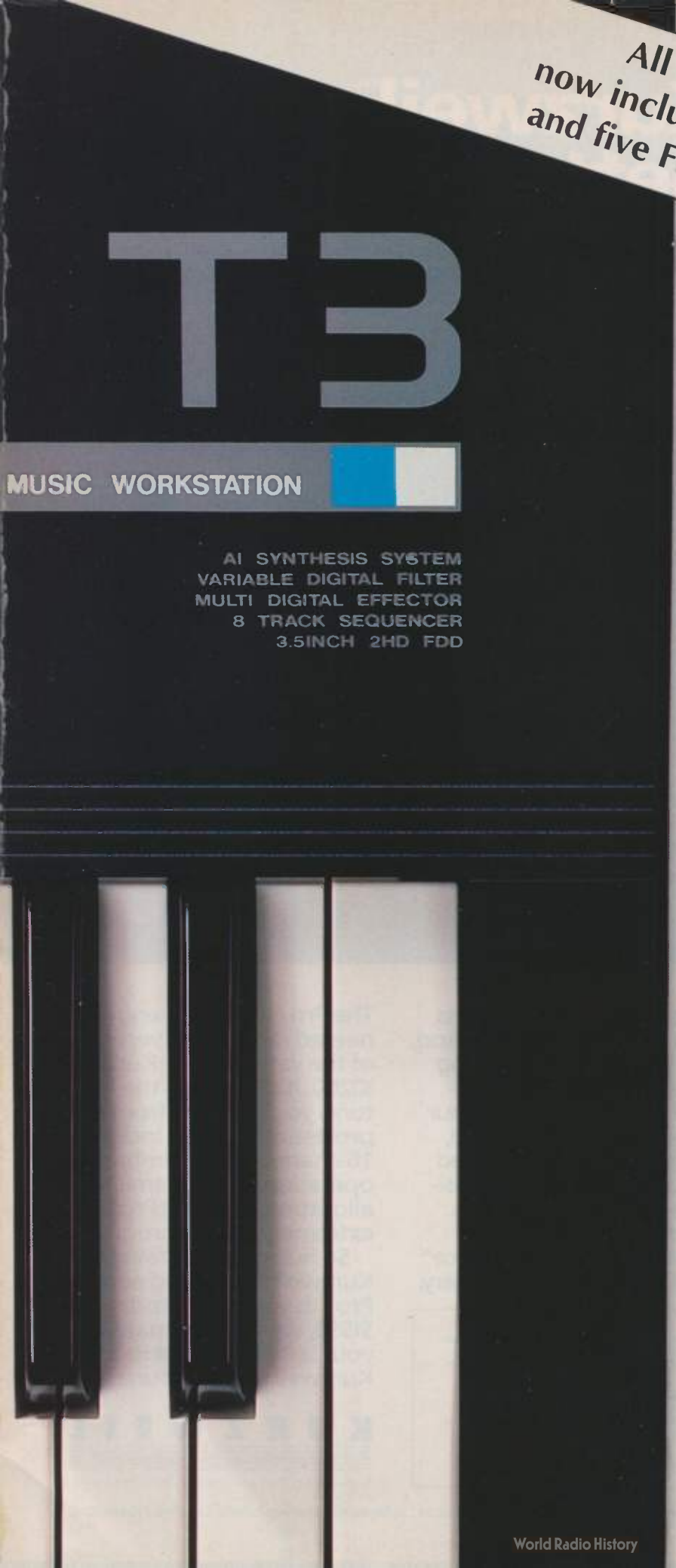

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Electronic Musician

AN ACT III PUBLICATION
APRIL 1991 VOL. 7, NO. 4

features

columns

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reviews

departments

Cover: Photo by Rob Cardin.

Electronic Musician: (ISSN: 0884-4720) is published monthly by ACT III Publishing, 6400 Hollis St. #12, Emeryville, CA 94608. This is Volume 7, Number 4, April 1991. One year (12 issues) subscription is $24; outside the U.S. is $44. Second Class postage paid at Oakland, CA, and additional mailing offices. POSTMASTER: Send address changes to Electronic Musician, PO Box 41094, Nashville, TN 37204.

Future Retro

Today's microprocessor-based technological developments are merging with traditional electronics to produce some interesting new hybrid products.

If you made the pilgrimage to the musical instrument industry's Mecca—otherwise known as the Winter NAMM (National Association of Music Merchants) show—you may have felt as if you inadvertently slipped into a time machine. (For more detailed show coverage, see this month's "What's New.") Prominent on the show floor were new instruments and signal processors that contained components often relegated to the dustbin in today's digital age: tubes, drawbars, knobs, analog oscillators, and more. It was a traditionalist's heaven.

This wasn't simply a return to the past. Many new products combined elements of "old" technology with elements of the new to form intriguing hybrids. For instance, DigiTech showed the GSP Tube and ART displayed the SGX-2000, a pair of MIDI-controlled digital effects processors with guitar-oriented tube preamps; Roland's VK-1000 and Hammond's XB-2 are programmable, MIDI-equipped, single-manual organs with drawbars; Roland unveiled the JD-800, a digital synthesizer with *lots* of sliders and knobs; Oberheim previewed a true analog synth with a complete MIDI implementation; and Korg presented the Wavestation A/D, a rack-mount, digital synthesizer with analog audio inputs.

These developments failed to hinder digital technology's march forward, however; several cutting-edge products were introduced. For example, Alesis's early showing of a prototype, 8-track, digital tape recorder for under $4,000 proved that high-tech is still hot. But there was an undeniable resurgence of interest in older types of technology.

Unlike previous retro movements in product design, this one takes the mature attitude that the often-separated worlds of hi-tech digital equipment and comparatively low-tech analog gear (or at least analog concepts) can function peacefully, side-by-side, in a single instrument or processor, each offering benefits to the final product.

On a more global level, it appears the musical instrument industry is rediscovering the good qualities of technology it had seemingly abandoned in pursuit of "progress." In retrospect, the desire to make everything digital may have encouraged some product designers to start from scratch, ignoring functional, existing technology.

Certainly, limitations in processing power and functionality of older technologies remain compelling reasons to use digital gear. But continual calls for the sonic qualities and usability of older equipment finally may have made an impact. Manufacturers seem to be saying there is, in fact, a place for older technology in newer products. People tend to think this incorporation of older concepts is a step backward in product development, but I believe the opposite is true. The melding of older technologies and ideas with the latest technical developments has transported these products into a new era.

Of course, just because manufacturers offer them doesn't mean a significant number of electronic musicians will use these new products. We'll see if the support is there when it's time to make buying decisions.

Though a few hiccups may occur along the way, the successful melding of old and new has potential to produce rewarding instruments that meet the requirements of many electronic musicians.

Bob O'Donnell

Electronic Musician

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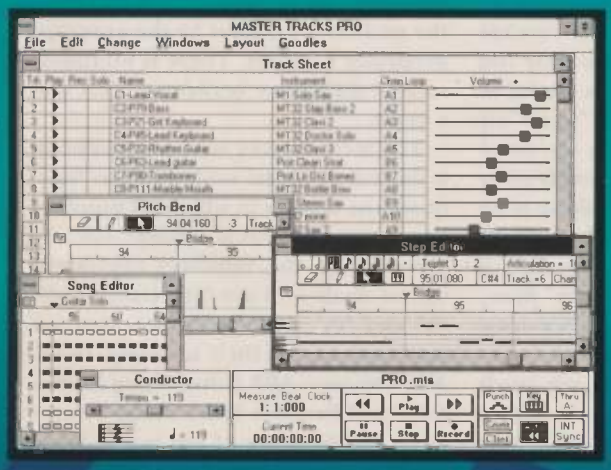

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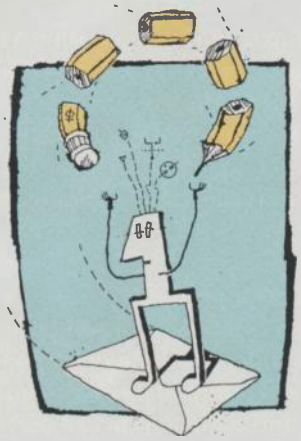
Our readers request more synth-programming articles, expound on amplitude modulation, and discuss theater organs as "live-performance" synthesizers.



MORE SYNTH STACKS

I particularly enjoyed your article on synth programming ("Monster Synth Stacks" in the February 1991 issue). The intelligent use of amplitude envelopes, pitch envelopes, oscillators, etc., is a skill eluding many of us beginning electronic musicians. I would love to see a series of articles that could bring us beginners a working knowledge of how to use these tools. For instance, I would like to create a flute patch. What type of waveform should I start with, and what do you use to shape it into a breathy sound? How are white and pink noise used?

If a series of articles would be too comprehensive for this subject, perhaps you could point the way with "suggested reading." Keep up the good work.

Dean Robinson
Renton, WA

Dean—Come to think of it, we haven't done many synth programming articles lately, so we'll work on that. Meantime, A Synthesist's Guide to Acoustic Instruments, *by Massey, Noyes, and Shklair (published by Amsco and available from Mix Bookshelf; tel. [800] 233-9604 or [415] 653-3307) offers lots of flute and other emulative synthesis ideas. You'll discover that how you approach programming a flute depends on the type of synth "at hand."*

I like analog synthesis for flutes. Although many programmers use sine waves to build flute sounds, I prefer a lowpass-filtered, slightly waveform-modulated sawtooth, with a bit of resonance on the filter. The raw sawtooth waveform little resembles the filtered, modulated version, though, and I've heard flute patches made of various raw waveforms. I use a stacked voice to supply pink noise for the "breath" sound and find the envelope controlling the amplitude of the noise (the DCA, or VCA for dinosaurs) is crucial in bringing in the right amount of "breath" for the right duration. I also vary the attack portion of the envelope and the amplitude of breath noise as a function of velocity to get more and faster "breath" with a "hard" keystrike. As always, use your ear. Even if you enjoy using sampled "acoustic" flutes, consider analog synth flutes, too. Sometimes you don't want the "real thing."

As to white versus pink noise, very loosely defined, white noise is a random waveform in which, as with white light, all frequencies ("colors") are present. Human ears don't hear evenly, though, and detect the high frequencies in white noise better than the lows and mids. Pink noise results when white noise is filtered so that its content more closely matches the human ear's frequency response.—Steve O.

MODULATING VIEW

Thank you for publishing "Understanding Amplitude Modulation" by John Duesenberry (in the November 1990 issue). It was full of technically accurate descriptions of fundamental principals that are important to synthesis, yet often go overlooked. There were, however, two small technical errors that I wish to correct.

The first was in the article itself; when describing amplitude modulation in the time domain, the author adds, "Note that this is different from gating or keying, in which the overall level of an audio signal is controlled by another signal." This is not true. Multiplication of each instantaneous value by a constant is algebraically equivalent to multiplying the average of the values by the same constant. Thus, keyer circuits such as those used in the ARP Omni II or the Moog Opus 3 are performing amplitude modulation, modulation of the oscillator's output by the envelope generator's output. There is no fundamental difference between a VCA and a keyer.

The second error was in the sidebar; it described digital multipliers as "one-quadrant devices in which all numbers are positive..." This is a subtle, but real error; while the numbers the digital circuit deals with are bits, traditionally "1" and "0," it is not the bits that are operated on, but their meaning. In the ARP Odyssey, ARP Solus, Moog Liberation, and Realistic MG-1 Moog Synthesizer, the meaning of the two states of the bit are as follows: Low corresponds to a signal level of -1, while High corresponds to a level of +1 (see **Fig. 1**).

Note: In Figure 1, the output of the XOR-gate more closely resembles that of the four quadrant multiplier than that of the one quadrant multiplier. The difference is the output of the XOR-gate is inverted, but to the human ear, inverted signals are indistinguishable from their non-inverted counterparts. Thus, the XOR-gate functions as a true 4-quadrant multiplier, with the only limitation being that the input waveforms are limited to square and pulse.

Finally, a note on the use of the term "ring modulator": A traditional, 2-quadrant, diode keyer is made with two diodes in series. This arrangement leaks the modulator signal through to the

DAVID POVILAITIS

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0	1	0
1	0	0
1	1	1

XOR-gate

Carrier	Modulator	Out
0	0	0
0	1	1
1	0	1
1	1	0

4-Quadrant Multiplier

Carrier	Modulator	Out
-1	-1	1
-1	1	-1
1	-1	-1
1	1	1

FIG. 1: Using an exclusive-or gate as a single-bit multiplier.

output, causing key clicks, but overall it still is functioning pretty much as a 2-quadrant multiplier. By taking two diode keyers and placing them in parallel, one in each direction, you get a 4-quadrant multiplier. In the schematic, the four diodes are typically shown in a ring configuration, similar to that seen in a bridge rectifier, and this is where the name "ring modulator" comes from.

David Hillel Wilson
New England Synthesizer Museum
Nashua, NH

The article's author, John Duesenberry, replies: *David Wilson is correct in saying gating and keying are forms of amplitude modulation, in the most general sense. They are not forms of AM synthesis, however; to generate audio sidebands you need audio-rate signals at the inputs of your multiplier.*

His second point arises from a misreading. The article stated that some (not all!) digital multipliers are 1-quadrant (such as the "ring modulator" in the Kawai K4). Most, of course, are not; a programmer implementing AM usually chooses to perform signed arithmetic on signed operands, unless there is good reason to do otherwise. This, by definition, is true 4-quadrant multiplication, assuming overflow errors are avoided. David's discussions of logic gates, while interesting, have no particular relevance here.

The article did mention the origins of the term "ring modulator." Here again we are in agreement. I once heard a music store "expert" describe a ring modulator as "a gizmo that makes ringing sounds."

UNVEILING THE AUTHOR?

While reading "Unveiling The Mystery" (January 1991 EM), I noticed a definite emphasis on sample playback instruments. Surely an article on "The Basics of Electronic Music" would mention some other methods of sound creation (FM, subtractive, additive), right? Nope.

I read that the author (Dan Phillips) is a product specialist for Korg, makers of popular sample-playback machines. Suddenly, the sentence "these [sample-playback] instruments often prove to be the best of both worlds and are an excellent choice for the first-time buyer," stood out prominently in my mind.

I am not accusing the author of bias in his article. However, he does work for a company whose products match many descriptions in the article. Therefore, I advise him to make doubly sure his articles sound unbiased. Whether Phillips intended it or not, I definitely perceived this emphasis, and I doubt I am alone.

One final comment: I wish EM and other magazines would not use the word "sample" when they mean "sampled sound." Misusing terminology results in awkward sentences in which "sample" means two different things; for example, "This sample was recorded at a rate of 20,000 samples per second."

Daniel J. Barrett
Baltimore, MD

Daniel—This beginner's article attempted to cover a lot of ground, so rather than go into the intricacies of various synthesis methods and throw out a bunch of potentially confusing terms—such as analog synthesis, additive synthesis, FM, etc. (which, incidentally, are explained in the February 1991 "From the Top" column)—we chose to focus on general principles. The fact is, samples and sample playback are easy to understand on a conceptual level. I specifically asked Dan Phillips to mention that sample-playback instruments are a good choice for beginners. Most people new to electronic music want high-quality acoustic emulations as well as synthetic sounds, and sample-playback instruments (as well as their wavetable-brethren) best suit those requirements. Finally, sample-playback instruments, which are produced by every major synth manufacturer, happen to be the most popular type of synthesizers currently available.

"Sample," like many words, has several meanings and can be used correctly in several ways. Following your logic could result in even more awkward constructions, such as "sampled sound-playback instrument."—Bob O'D

MIDI BASS GUITAR?

What can a bassist do when pop music today is relying heavily on synth bass lines? I don't play keyboards, but I need to trigger a sound module to get these bass sounds. Is there a pitch-to-MIDI converter for bass, or better yet, a MIDI bass guitar on the market that I don't know about?

Jeff Van Beek
New York, NY

Jeff—Unfortunately, you're out of luck. Roland once produced a MIDI bass guitar system, but it has long since been discontinued. Valley Arts Guitar imported an Australian MIDI bass guitar converter, but it, too, is no longer commercially available. You might find one of these systems used, but try it before you buy: Both products were based on pitch-to-MIDI conversion and consequently had a relatively slow response time. Try one of the many MIDI guitar systems.—Bob O'D

ERROR LOG

February 1991, "Expander Module Manufacturers" (sidebar), p. 88: An Oberheim product rep's office phone number was published. The correct Oberheim/Gibson Labs number is (800) 765-4629.

February 1991, "ZimmerWorks Zeebar," p. 114: On Ensoniq instruments, the Zeebar replaces the CV pedal and can be set to send either MIDI controller 7 (volume), or controller 4 (MIDI footpedal), but not controller 1 (mod wheel), as stated.

March 1991, "The Computer as a Musical Instrument," p. 42: The list of manufacturers should have included software developer Dr. T's Music Software, 100 Crescent Rd., Suite 1-B, Needham, MA 02194; tel. (617) 455-1454. Dr. T's many products include *Music Mouse, KCS, X-oR,* and *Beyond.*

CALENDAR

April 3-7, 1991: The Center for Contemporary Music (CCM) at Mills College, in Oakland, CA., is hosting The Electronic Music Plus Festival. The festival includes four concerts of live electronic performance, three concerts of tape music and video, and a panel discussion on live performance. For information, call (415) 430-2191.

NAMM Show Report, Part 1

Despite war in the Middle East and an ailing economy, this year's winter NAMM show was quite lively, with lots of interesting new products.

By the EM Staff

GEORGE PETERSON

The Anaheim Convention Center's aisles were full at this year's Winter NAMM Show.

The 1991 Winter National Association of Music Merchants (NAMM) Expo, held in Anaheim, began with some unexpected news: The 1991 summer NAMM show in New York had been cancelled due to lack of interest. Many exhibitors dread the financial and time requirements of a mid-year show, especially since the last several summer shows were poorly attended, and a New York show would be particularly demanding. With the exception of a few particularly intriguing new products, the cancellation announcement was the show's biggest—and to some, most welcome—surprise.

That's not to deny there were lots of cool devices and programs, though. Despite general concern and fear of flying due to the Persian Gulf war, most exhibitors and attendees were ready and eager to talk business. In fact, there were so many new products that we need two "What's New" columns to cover just part of what we saw. This month, we'll discuss a variety of hardware, and next month we'll cover MIDI accessories, signal processors, and software. Some new stuff is shipping, some items are almost shipping, and some are so far away they may never become real—and if they do, they may look different, work differently, and be priced differently. But it all was on display for music-store buyers to ogle (this really is a merchants' show). So with the understanding that change is constant in music products as in life, let's get on with the show.

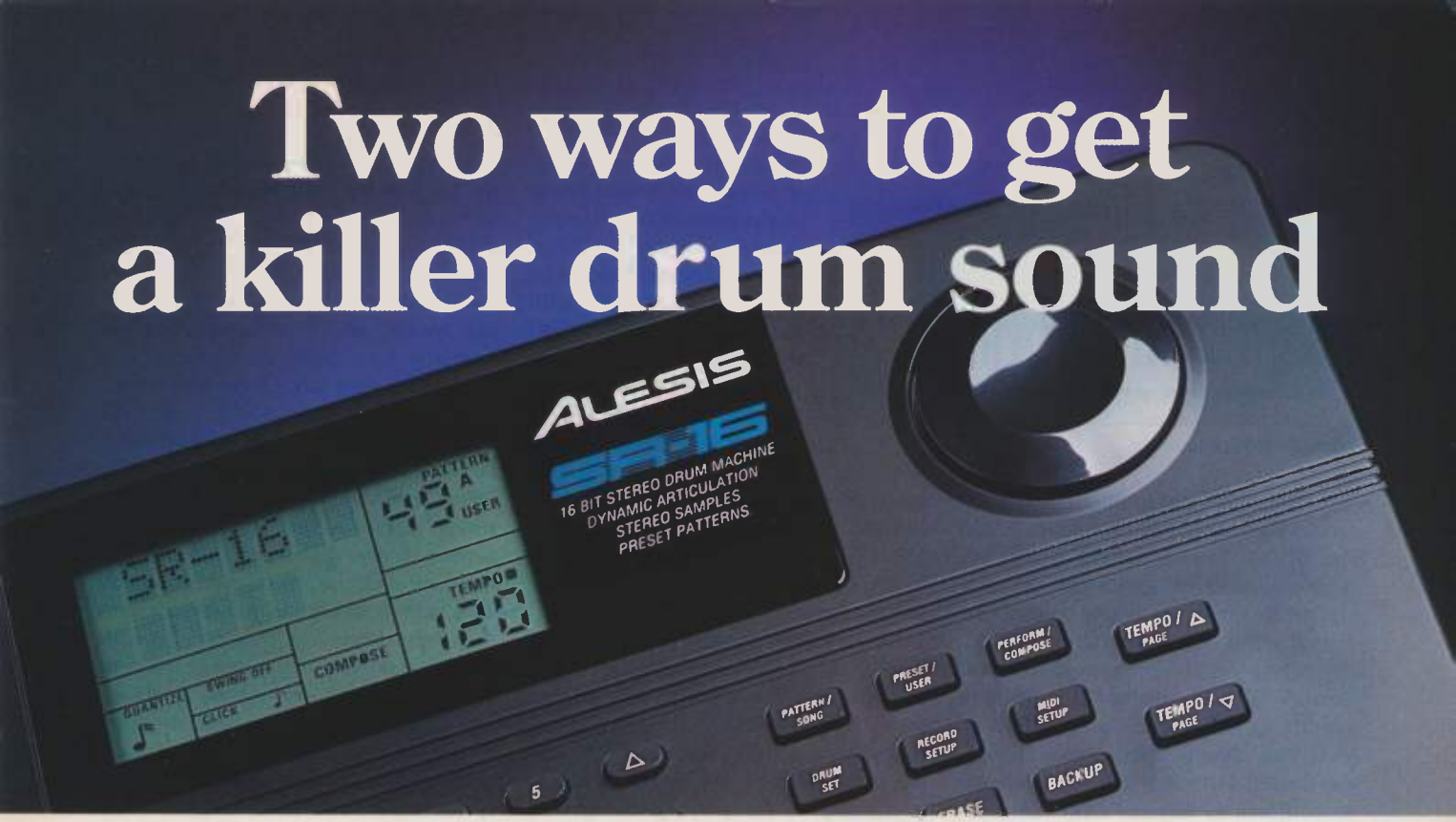
SYNTHS AND STUFF

Several major new synths, as well as a few variations on familiar themes, were introduced in Anaheim. The most interesting newcomer was the Kurzweil **K2000** (tel. [617] 890-2929; approx. $3,000), scheduled for a summer release, which is based on the company's new Variable Architecture Synthesis Technology (VAST). At the core of the instrument are two new Kurzweil-designed chips, one of which is a general purpose DSP optimized for digital audio applications. The instrument is completely reconfigurable via software and offers 31 different algorithms for allocating the processing power and function of the DSP. As the VAST acronym suggests, the 24-voice K2000 performs any of several different synthesis and sound modification techniques, but most impressively, it can do many of them at once. For example, *a single patch*, or any of the sixteen simultaneous patches available in a multitimbral setup, can use the instrument's 16-bit ROM-based samples (8 MB of which are provided) for some voices, and simple AM or FM synthesis for other voices, and the complete sound can run through a resonant digital filter. The instrument also includes a disk drive, SCSI port, onboard effects, a large 240 x 64 LCD, and a total of six outputs.

Roland (tel. [213] 685-5141) unveiled several impressive instruments. Receiving the most notice was the **JD-800** ($2,895), a digital, sample-based synthesizer with lots of analog-style controls (63 buttons, 59 sliders, and three knobs, to be exact) and four audio outputs. Utilizing a straightforward, subtractive synthesis structure that includes multifunction, resonant, digital filters, the 24-voice JD-800 offers 108 different waveforms in 3 MB of ROM. The sliders basically function as a built-in programmer, which makes real-time sound-manipulation easy. Consequently, the JD-800 is positioned as a performance instrument. It also can function as a 6-part multitimbral sound source, however, and each of its individual parts can have independent signal processing. When a single patch is played, you can use up to seven simultaneous effects.

On the opposite end of the price spectrum, Roland introduced two in-

Two ways to get a killer drum sound



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Roland JD-800 Synthesizer

teresting half-rack modules, the **SC-55 Sound Canvas** ($795) tone module and the **SB-55 Sound Brush** ($695) sequencer, both of which can be controlled by a single remote control. Essentially the successor to the MT-32, the 24-voice, 16-part multitimbral Sound Canvas offers 315 built-in sounds, nine drum sets, and built-in reverb and chorus effects. In addition, the Sound Canvas is the first product to conform to Roland's GS standard, which establishes program numbering conventions (i.e., a piano is always Patch 1), MIDI channel assignments, and the assignment of individual parameters to controller numbers instead of sysex. The Sound Brush sequencer offers simple record and playback functions and is intended to be used in conjunction with computer-based (software) sequencers. To that end, it is capable of both reading Standard MIDI Files from any MS-DOS-formatted disk and writing standard MIDI files to disk. Along similar lines, Roland introduced **MRM-500** Standard MIDI File converter software ($110) for its MC-50 and MC-500 line of hardware sequencers.

Roland also introduced the **JX-1** ($895), an entry-level, 24-voice performance synthesizer with 64 preset sounds, built-in effects, and the ability to make macro-level changes to the presets. The JX-1 also features stereo audio inputs for playing along with prerecorded material or another instrument, such as a drum machine. Roland's **S-750** ($4,995) is a less expensive version of the company's S-770 16-bit, 24-voice, stereo sampler (reviewed in the January 1991 issue). The S-750 lacks an internal hard disk and the digital inputs offered on the S-770, but otherwise it's identical. It even has the new version 2.0 of the S-770's operating system, which includes a refined user interface, digital compression and expansion, time stretching, and more.

New to Roland's Rhodes line is the **VK-1000** ($3,295), one of two keyboards at the show to feature drawbars. The 16-voice S/A sound source includes twelve types of organ, chime, and lead sounds. It also offers percussion, click, and Leslie effects for its organ sounds. The beefy-looking instrument features a 76-note keyboard that can have its velocity sensitivity turned on or off, four assignable pedal inputs, and a mic input that can be used to mix an audio source with the VK-1000's output.

Moving to the far side of the size spectrum, Yamaha (tel. [714] 522-9011) introduced the **QY10** ($399), an impressive example of miniaturization. Crammed inside the battery-powered, videotape-sized, 11-ounce box is a 28-

A FEW STEPS FORWARD. AND ONE STEP BACK.

The Yamaha SY77 was just released last year and already it's been improved. But not the kind of improvements that make most synths obsolete. It's quite the opposite.

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And that's in addition to everything else it can do. The SY77 is not like any other synth. In fact, it's more like several. It functions as an FM synth, a sample playback synth, a hybrid synth capable of layering both FM and AWM samples together, and an RCM interactive synth.

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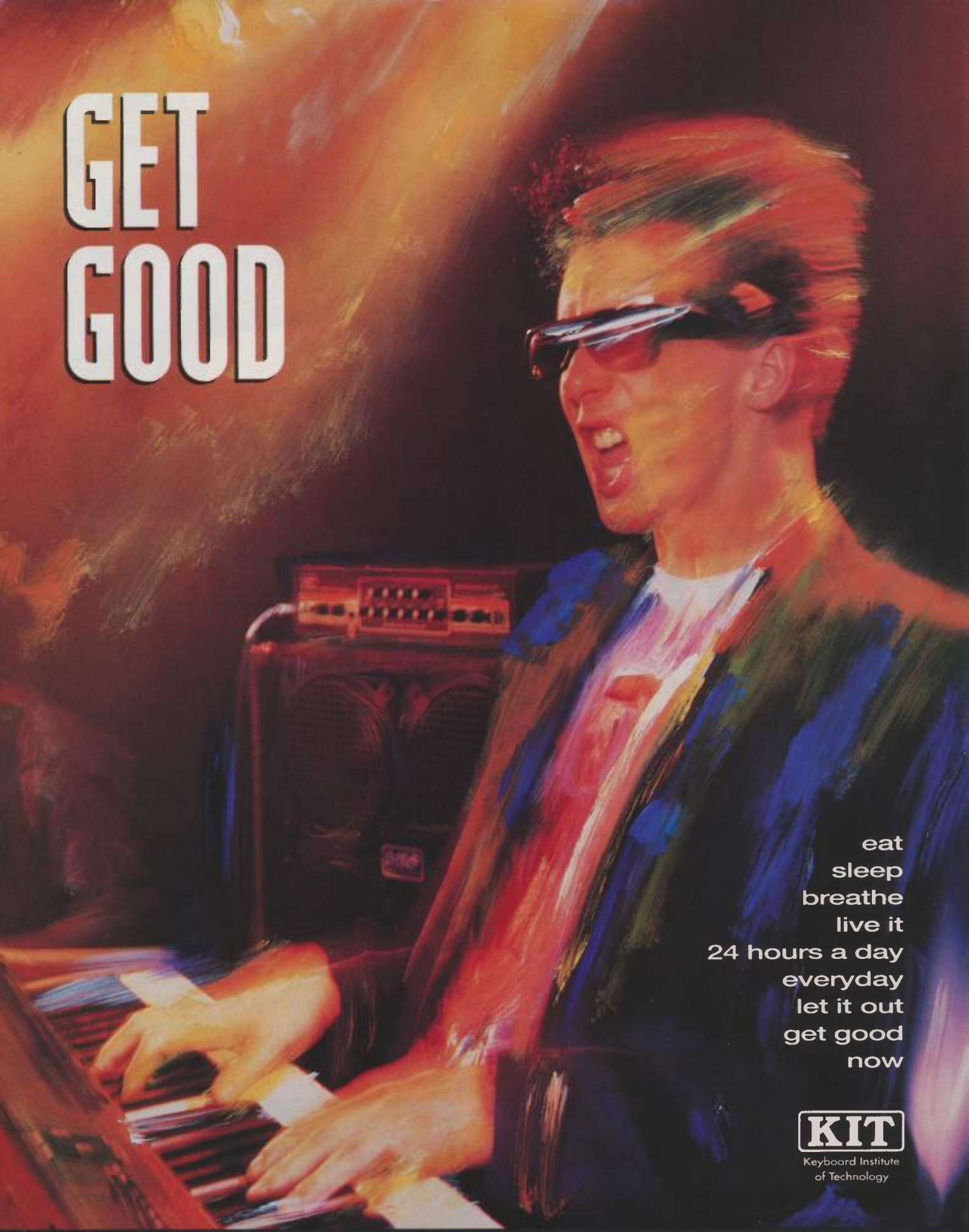


voice tone generator with 29 sampled instruments, a complete drum kit with 26 sounds, an 8-track/8-song sequencer with real-time and step-time recording and editing, a keyboard pad for inputting notes, a separate group of buttons for entering any of twenty chord types, and an LCD display. Up to eight multitimbral parts can be played at once through the box's stereo outs or its independently controllable headphone jack. The QY10 offers 76 preset, 4-track rhythm patterns and room for 24 user-defined patterns.

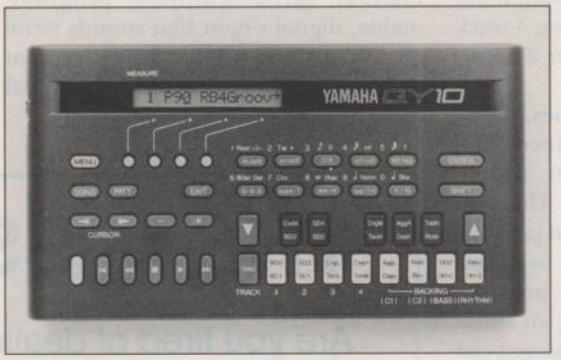
Along somewhat similar lines, Kawai (tel. [213] 631-1771) introduced the **GB-2 Session Trainer** ($349), an enhanced version of the GB-1. The unit contains 48 preset background patterns that play internal PCM drum, bass, and chord sounds; the ability to program your own chord progressions; an audio input with an overdrive effect so you can play along with the patterns; and a card slot for accepting new pattern styles.

Peavey (tel. [601] 483-5365) had several new synth introductions. The **DPM-2** ($1,395) is a less-expensive version of the DPM-3. It offers most of the functionality of the DPM-3, including the same voice architecture, the same built-in 4 MB of sample ROM, and the same effects, but it has sixteen oscillators instead of 32 and lacks a sequencer and disk drive. A rack-mount version, the **V2** ($899), also is available. The **DPM-SP** sample-playback module (price unavailable) is a single-rackspace, 16-bit, 16-voice multitimbral module that can play back samples loaded into its memory via its onboard, high-density floppy disk drive or MIDI Sample Dump. The machine ships with no installed memory, but up to 32 MB can be installed by the user via standard Macintosh SIMMs. The DPM-SP features four polyphonic outputs, a standard SCSI port, and basic sample-editing functions, including looping, trimming, and sample-mapping. If you combine the DPM-SP, DPM-2, or DPM-3 with Peavey's recently announced **DPM-SX** sampling expander ($349), which consists of a mono 16-bit A/D converter with multiple sampling rates and slots for plug-in memory in a single rack space—in other words, the front end of a sampler—you get a complete, 16-bit sampler.

Waldorf, distributed in the U.S. by Russ Jones Marketing (tel. [818] 993-4091), introduced the **WaveSlave** ($1,299), a 1U rack-mount, 8-voice expander for the company's MicroWave wavetable synthesizer. The WaveSlave features audio inputs for merging the audio from a MicroWave and communicates with, and is controlled by, a host MicroWave via MIDI.

One of several surprises at this year's show was the Hammond (tel. [708] 620-6633) **XB-2** ($1,995), a single-manual, MIDI-equipped, programmable, digital organ that sounds virtually identical to a B-3. The instrument features drawbars, percussion, a digital Leslie simulation, MIDI controller features, an LCD display, and a standard 11-pin jack for connecting to a real Leslie speaker.

Also in the retro vein, Oberheim (tel. [800] 765-4629) introduced an as-yet-unnamed rack-mount, 12-voice polyphonic and multitimbral, **analog synthesizer** (basic synth $1,500; fully loaded $5,000) with both Minimoog and Oberheim SEM filters. (You can pan between the two.) The box holds several voice cards, which can be purchased separately, so you can increase



Peavey DPM-2 Synthesizer and Yamaha QY10

its polyphony as your needs grow. A Link function lets you route the output of a voice to the input of another voice, and you also can put the filters in series or parallel within a voice, allowing multiple filtering and other programming delights. The instrument has a complete MIDI implementation and an LCD display but also is positively awash in knobs—that's right, real knobs. The company also formally announced the reintroduction of the **Matrix-12** ($6,399).

The most interesting new digital piano introduced at the show was Casio's **Celviano** (tel. [201] 361-5400; no list price). In addition to an 88-key, weighted keyboard, eight 16-bit sampled sounds, built-in reverb, a 2-track sequencer, MIDI, and speakers, the top-of-the-line **AP-7** includes a CD player. (The less-expensive **AP-5** offers everything but the CD.) You can use the CD player to play along with commercial recordings, and if you don't like the speed of a tune, you can slow it down and the keyboard automatically transposes to the right key. In addition, the AP-7 allows you to selectively mute the left, right, or center channel and play or (courtesy of a mic input jack) sing along. Casio also will offer educational and entertainment-oriented CDs that have left-hand parts in the left channel and right-hand parts in the right so that you easily can practice individual hands.

In a completely different vein, Casio also introduced the **Rapman** ($99), the world's first rap keyboard and one heck of a fun toy. The mini-keyboard includes 30 built-in rhythm patterns, 25 sounds, a scratch wheel, three effects pads, a microphone, a crude but fun pitch shifter, and a built-in speaker. From all appearances, the Rapman could just be the next SK-1.

DRUM MACHINES AND RELATED DEVICES

Yamaha's newest drum machine, the **RY30 Rhythm Programmer** ($595), offers an intriguing twist: a pitch-bend wheel. The wheel can be used to alter—in real time—pitch, decay, panning, a filter cutoff frequency, and volume. In addition, a timing-shift mode allows individual drum hits to be moved slightly ahead of or behind the beat. The RY30 features 2 MB of 16-bit samples, velocity sensitive pads with 128 different levels, a card slot for adding new waveforms, and a total of four outputs. Yamaha also introduced the **DTS70** drum trigger system ($945). This rack-mount unit offers sophisticated MIDI and dynamic triggering options for each of twelve trigger inputs. Its many options include stacking, crossfading, or alternating up to four notes per input. The unit also features quick and easy trigger and MIDI learn functions.

In the world of drum machines and modules, Roland showed the **CR-80** ($750), a preset drum machine that utilizes the "human feel" technology the company first introduced in its R8 and R5 drum machines. The unit includes 69 16-bit sounds and 36 rhythmic styles, including Lambada and House. Alesis (tel. [213] 467-8000) introduced the **D4** ($399), a 1U rack-mount sound module that includes all the HR-16 and HR-16:B sounds, most SR-16 sounds, and many new samples (sampled at 48 kHz). The unit features four audio outputs and six trigger inputs for triggering sounds from drum pads. KAT (tel. [413] 594-7466) displayed a few new drum pads that could make use of those

D4 trigger inputs, including the 11-inch **tomKAT** ($189) and the **kicKAT** ($259).

After an earlier false start, Cheetah (distributed in the U.S. by Jessico; tel. [800] 458-5515 or [301] 949-9314) announced the **MD16** ($690), a 16-bit drum machine. The machine features 41 sounds, touch-sensitive pads, eight outputs, 96 ppqn resolution, and fairly extensive voice-editing options. A rack-mount version, the **MD16R**, is available for $770.

DIGITAL FOR THE REST OF US

It seems 1991 is the year for honest-to-goodness digital multitrack recording under $10,000, and we will have our choice of tape or disk, computer-based or stand-alone units. The bad news is that we will wait until later in the year (at least) for most of these products to materialize.

Alesis (tel. [213] 467-8000) caused quite a stir with its **ADAT Digital Recording System**, even though no audio was playing and delivery is not expected until the end of 1991. The ADAT is a 3U rack-mount unit that can record approximately 40 minutes of 8-track, 16-bit digital audio, at a sampling rate of 48 kHz, on a standard S-VHS video cassette. The unit provides unbalanced (¼-inch phone jacks) and balanced (on 56-pin ELCO connectors) inputs and outputs. According to Alesis, any number of tracks can be recorded while other tracks play in sync, with punch-in/punch-out capability. The announced price for an 8-track unit is $3,995, with synchronization built in. As many as sixteen ADATs (128 tracks) can be operated as a single unit.

Roland's new Pro Audio/Video Group (tel. [213] 685-5141) showed the **DM-80 Hard Disk Recorder System** (described in the December 1990 "What's New"). Only audio playback was shown, without editing, but Roland appears to be refining its design for shipments this summer. The biggest news was a substantial drop in the announced list price, down to $5,495 for a 4-track system with a 100 MB drive and $7,695 for the 8-track version with two drives. Expansion options include the **DM-80-R** remote ($1,995) and the **DM-80-F** fader unit ($1,695). Recording time can be expanded with standard SCSI hard disks, and multiple DM-80s can be operated in sync using the remote or Macintosh software.

The award for first delivery goes to

Spectral Synthesis, of Woodinville, WA (tel. [206] 487-2931). Their PC-based **Digital Studio** system supports eight tracks on hard disk (expandable to sixteen), with complete editing and mixing capabilities built-in. The system is modular in concept, and you can buy your own computer (hard disks are supplied by Spectral), so the cost varies. Spectral sells packaged systems starting from $6,995 ($5,695 without converters). Currently, the system is limited to two channels of I/O (analog or digital), but a multichannel input/output card is due for release by early spring.

AUDIO FOR THE REST OF US

Meanwhile, recording and performance go on, and Soundcraft (tel. [818] 893-4351) wants to serve both. Their new **Spirit Live** console line includes three models, from $1,295 (eight channels) to $3,495 (24 channels). These are 3-bus mixers (left/right and mono), with four effects sends with stereo returns. The **Spirit Studio** series 8-bus consoles

Soundcraft Spirit Studio Mixers

($3,995 for sixteen channels, $5,650 for 24) include tape-return inputs and direct outputs on every channel. The tape returns can be combined with the line or mic inputs, effectively doubling the number of inputs for mixdown (appropriate for the era of sequencer/multitrack tape combos). Both designs appear to be very solid and show lots of attention to details that make the difference in audio quality and human factoring.

At the opposite end of the mixing spectrum, MIDIMAN (tel. [818] 449-8838) showed the **FineLine** ($349.95), perhaps the ultimately streamlined line mixer. Following the philosophy of their MiniMixer (reviewed in the January 1991 issue), the FineLine is a single-rackspace unit that is without level controls on its twenty line inputs (switchable as twenty mono, or ten stereo inputs). There is an output level control and a pair of active/clip LEDs for each group of ten inputs, and four of the inputs can be mixed to a single "send" output. In addition, there are four XLR microphone inputs with individual level controls (deluxe!) and left and right outputs that are separate from the main mix outs.

If you want to add mix automation to *any* mixer, you may already have discovered the Niche ACM gain control module (reviewed in August 1990). This show, Niche (distributed by Steinberg/Jones; tel. [818] 993-4091) dropped the other shoe with the **Mix Automation Station**, or MAS ($595). Also nicknamed the "Fader Monster," the MAS provides all the facilities you could want for controlling a multitrack/sequencer mix. There are sixteen individual faders, each with a momentary Mute/Solo/Write switch and a single LED indicator. The left side of the panel features a set of tape-recorder-style transport-control keys and a Jog/Shuttle wheel. Best of all is the use of the MAS's LCD window to show bar graphs of the mix level over time. The MAS stores snapshot mixes internally and tran-

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STUDIO TIMES

SEPTEMBER 1990 Cutting Edge News For the Contemporary Musician VOL. 16 NO. 9

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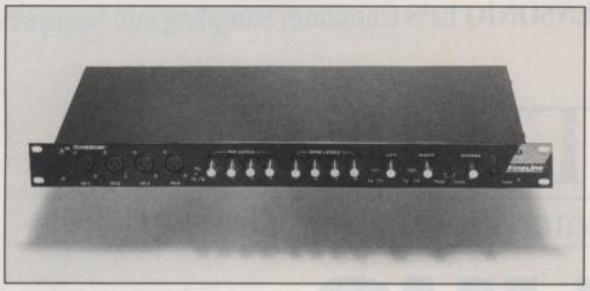

MIDIMan FineLine

smits any MIDI information, including real-time and system exclusive messages.

SYNCHRONIZATION FOR EVERYBODY

For years, **Roland's** SBX-80 was the *de facto* standard for synchronizing SMPTE time code with MIDI. Now, Roland has introduced the **SBX-1000** ($3,495), a deluxe model that combines time code read/write with tempo-mapping and two separate, built-in sequencers. The first sequencer is set up as a cue list, with up to 30,000 events keyed to time code. An event can be any set of MIDI messages and/or a pulse or closure on any of the four GPI (General Purpose Interface) jacks (used to control non-MIDI gear such as tape recorders or video decks). The second sequencer is a 16-track, music-oriented model that can play Standard MIDI Files or disks from either Roland's MC-series sequencers or the sequencers built into Roland's keyboard products such as the W-30 or the MV-30.

Once again, MIDIMAN offers an alternative for those on a budget, with features for those who know what's happening. The SMPTE generator in the **Syncman Pro** ($599) locks to video, pilot tone, or house mains (50/60 Hz). The unit also stores up to 768 time code addresses for "MIDI Hits" (a MIDI note or program change). A footswitch input and a switch-closure output are provided for automated punch-in and punch-out, and MIDI tempo maps can be entered by tap entry, external click, manual entry, or "auto-recording" of a MIDI sequence. The Syncman Pro also can synchronize with an unstriped video tape by recording a short length of time code at the head of the tape. Once time code is acquired, the Syncman maintains lock by reading composite video.

STAY TUNED

That wraps up Part 1 of this year's NAMM show coverage. Next issue, we'll explore MIDI accessories, signal processors, software, and program upgrades. So tune in next month at the same **EM** time, same **EM** place, and same **EM** channel.

KEY CHANGES

We regret to announce the death of our friend, Yamaha Pro Audio Division advertising manager Bob Davis. He will be sorely missed in the audio industry. A Robert Trabue Davis Scholarship Fund to benefit the Central Kentucky Youth Orchestras (161 N. Mill St., Lexington, KY 40507) has been established in his memory.

A·fa·na·si·eff (ə´ fə nə´ sē ef), Walter

v.i.p. [Brazilian-born; Russian/American] **1.** *songwriter:* "Don't Make Me Wait For Love," "License to Kill," "Going Home," etc. **2.** *producer:* Mariah Carey, Michael Bolton, Peabo Bryson, etc. **3.** relies on **Peavey AMR Production Series™ 2400 Console** for production excellence and success **4.** [Colloq.] mega-producer —*adj.* state of the art; highly regarded; definitive.

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2	4	Independent MIDI Output Ports *(32/64 MIDI channels).*
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■	■	Includes diagnostic software.
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□	■	Generates all SMPTE frame rates *(24, 25, DF, 30, 29.97).*
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□	■	Converts SMPTE to MIDI Time Code.
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□	■	Automatic Frame Rate Detector.
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□	■	SMPTE Freewheeling compensates for variable length SMPTE dropouts.
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V-22	**$129.95**
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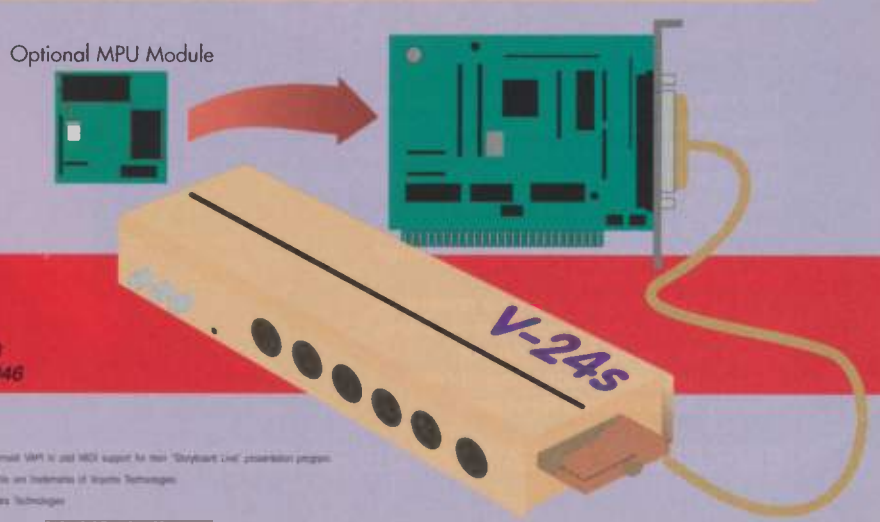

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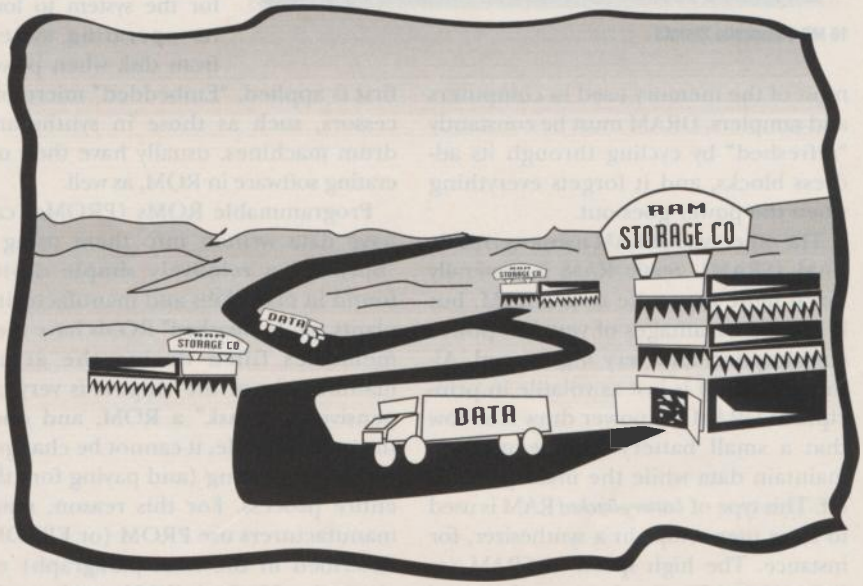
*IBM has licensed VAPI to add MIDI support to their "Storyboard Live!" presentation program.

All About Memory

By David (Rudy) Trubitt

If you can't remember the difference between EEPROM, PROM, DRAM, SRAM, and SPAM, let us refresh your memory.



WALDRON STANDISH

In 1945, John von Neumann circulated a paper describing a new design for digital computers. He, and others, believed that computers should be divided into two sections, *processor* and *memory*. The processor would perform the computation, while the memory would hold processor instructions (the program) and the user's data. The idea caught on, and the Von Neumann machine, as it became known, forms the basis of nearly all modern computers.

Memory, then, holds programs and data. But what are RAM, PROMs, megabytes, and SIMMs? We'll take you on a guided tour, so all aboard the memory bus!

MAY I HAVE A BIT OF YOUR BYTE?

Whether we're talking about sampler memory or CD-ROM, the smallest unit of memory is a *bit*. Bits are *binary* (also referred to as "high/low," "true/false," or "on/off"), meaning they hold either a one or a zero. Drawing an analogy to written human languages, bits may be thought of as the binary equivalent of letters. Bits grouped together form *bytes*, which are analogous to words. A single byte is often made of eight bits, although other *word sizes* are common. Depending on the type of data, thousands, or even millions of bytes may be required to store a useful amount of information.

Rather than spell out "million," metric prefixes are used to express large quantities. The prefix *kilo* means a thousand, *mega* a million, and *giga* a billion. (Metric prefixes also count small values: *milli* is a thousandth, *micro* a millionth, *nano* a billionth.) With metric prefixes, a little over 10,000 bytes becomes 10 kilobytes, or 10 KB for short. The letter "B" typically indicates bytes; the term "bits" usually is spelled out, although occasionally it is indicated by a lowercase "b."

How can kilobytes, or even megabytes, hold information beyond a bunch of ones and zeros? Let's look at one form of *data representation*. Eight bits can be arranged in 256 unique combinations (that's 2 raised to the eighth power). If each unique combination is assigned to represent one letter, digit, or symbol, English text can be stored as a series of 8-bit bytes. Other types of data—graphics, for instance—are represented in different ways.

THE STUFF OF WHICH MEMORIES ARE MADE

Now that you understand the concept of memory, the next question is: "How is it turned into real hardware?"

Punched cards were among the earliest means of storing machine instructions or programs. As early as the 1700s, they were used to program weave-patterns on textile looms. Player-piano rolls are a musical example of early machine programming. Although both punched cards and piano rolls can still be found today, modern memory is electronic, rather than mechanical, in nature.

What happens to electronic memory when the lights go out? Some types of memory retain information only when they're powered up (called volatile), while other types remember data even when power is turned off (nonvolatile).

Random-access memory (RAM) makes modern computers possible. RAM chips are integrated circuits (more about ICs in a moment) capable of storing and retrieving data written to it by a microprocessor or other circuit. RAM comes in two types. The most prevalent form, dynamic RAM (DRAM), is very low in cost per bit, and constitutes

16 MB Composite SIMMS

most of the memory used in computers and samplers. DRAM must be constantly "refreshed" by cycling through its address blocks, and it forgets everything when the power goes out.

The other type of RAM memory is static RAM (SRAM). Static RAM is generally much more expensive than DRAM, but it has the advantages of very low power consumption and very high speed. Although SRAM is just as volatile in principle as DRAM, its power draw is so low that a small battery can be used to maintain data while the main power is off. This type of *battery-backed* RAM is used to store user setups in a synthesizer, for instance. The high speed of SRAM (as little as ten *billionths* of a second to read a byte) becomes important in intensive number-crunching applications such as digital signal processing.

Read-only memory (ROM) chips are ICs whose data memory cannot be changed. Samplers require RAM (since the loaded waveforms will be changed repeatedly), while playback-only instruments such as the E-mu Proteus or Roland U-220 hold their unchangeable sounds in ROM. ROMs also are used on computer mother-boards to provide enough "smarts" for the system to load its operating system from disk when power first is applied. "Embedded" microprocessors, such as those in synths and drum machines, usually have their operating software in ROM, as well.

Programmable ROMs (PROMs) can have data written into them using a "burner," a relatively simple device found in many labs and manufacturing plants, while "masked" ROMs have their memories filled during the actual manufacture of the chip. It is very expensive to "mask" a ROM, and once the mask is made, it cannot be changed without repeating (and paying for) the entire process. For this reason, many manufacturers use PROM (or EPROM, described in the next paragraph) exclusively. Masked ROMs only make sense when several thousand copies of the same data are needed.

Erasable PROMS (EPROMs) can be "flushed out" (by exposure to ultra-violet light) and reprogrammed. This makes them popular for software development, and the "ROM upgrade" has become familiar to many owners of electronic music equipment.

Another type of PROM memory can be erased electrically (EEPROMs), and reprogrammed without removing it from its circuit board. Although data can be read from EEPROM at speeds comparable to RAM, erasing and rewriting new data is much slower. EEPROMs work fine in applications such as synth voice cartridges, where slower write times may not be an issue.

"Flash" EEPROMs (sometimes called "Flash RAM") are the result of a new semiconductor technology with some advantages over traditional EEPROMs. Principally, Flash EEPROMs have larger storage capacities (up to 2 MB) and significantly lower cost per bit than standard EEPROM. However, both types have a limit on the number of times they can be erased and rewritten. Standard EEPROMs can be rewritten up to 100,000 times, ten times the maximum number of Flash EEPROM write cycles.

All RAM and ROM chips are fabricated using integrated circuit (IC) technology. ICs are built, hundreds or thousands at a time, on a single wafer-thin slice of silicon, about eight inches in diameter. Through a process similar to silk-screening, layer after layer of various materials are deposited through different-patterned masks. In this way, millions of individual transistors and other components are created and

REVIEWING THE BASICS: Memory Buzzwords

Cache Memory (pronounced "cash"): A small amount of high-speed RAM used to hold data frequently requested by the processor. Caching increases the apparent speed of disk drives because if the processor requests data that's already in cache, the drive doesn't have to go looking.

CMOS (Complementary Metal Oxide Semiconductor): An IC manufacturing technology that produces chips that use much less power than other manufacturing techniques. CMOS ICs are often used with battery-powered equipment.

DIPs (Dual In-line Package): Bug-shaped, rectangular packages used to hold many types of ICs. DIP "legs" require holes that run through the circuit board, while newer surface-mounted IC packages don't.

DRAM (Dynamic Random-Access Memory): Overwhelmingly the choice of personal computer manufacturers, DRAM has fast read and write times but must be constantly refreshed or it will lose its data even though power is still available.

Parity: An error detection scheme for testing the accuracy of data. For example, parity is used to check data stored in memory, as well as data transmitted through modems.

SIMMs (Single In-line Memory Module): Small circuit boards that hold eight or nine surface-mounted RAM chips. Installing SIMMs is easier than installing DIPs, partly because you have eight or nine times fewer of them to install. Standard SIMMs have a single row of chips, and are currently available in capacities of up to 4 MB. Some manufacturers are making "high profile" SIMMs with multiple rows of chips, and these are available in configurations as large as 16 MB.

SRAM (Static Random-Access Memory): Faster and more expensive than DRAMs, SRAMs do not require refreshing, just a constant power source. They use much less power than DRAMs, and CMOS SRAMs are ideal for battery-backup applications.

SPAM: Meat product of indeterminate origin. Very popular in Hawaii. Often served in casseroles with Velveeta processed cheese food. Frequently subject of Monty Python jokes.

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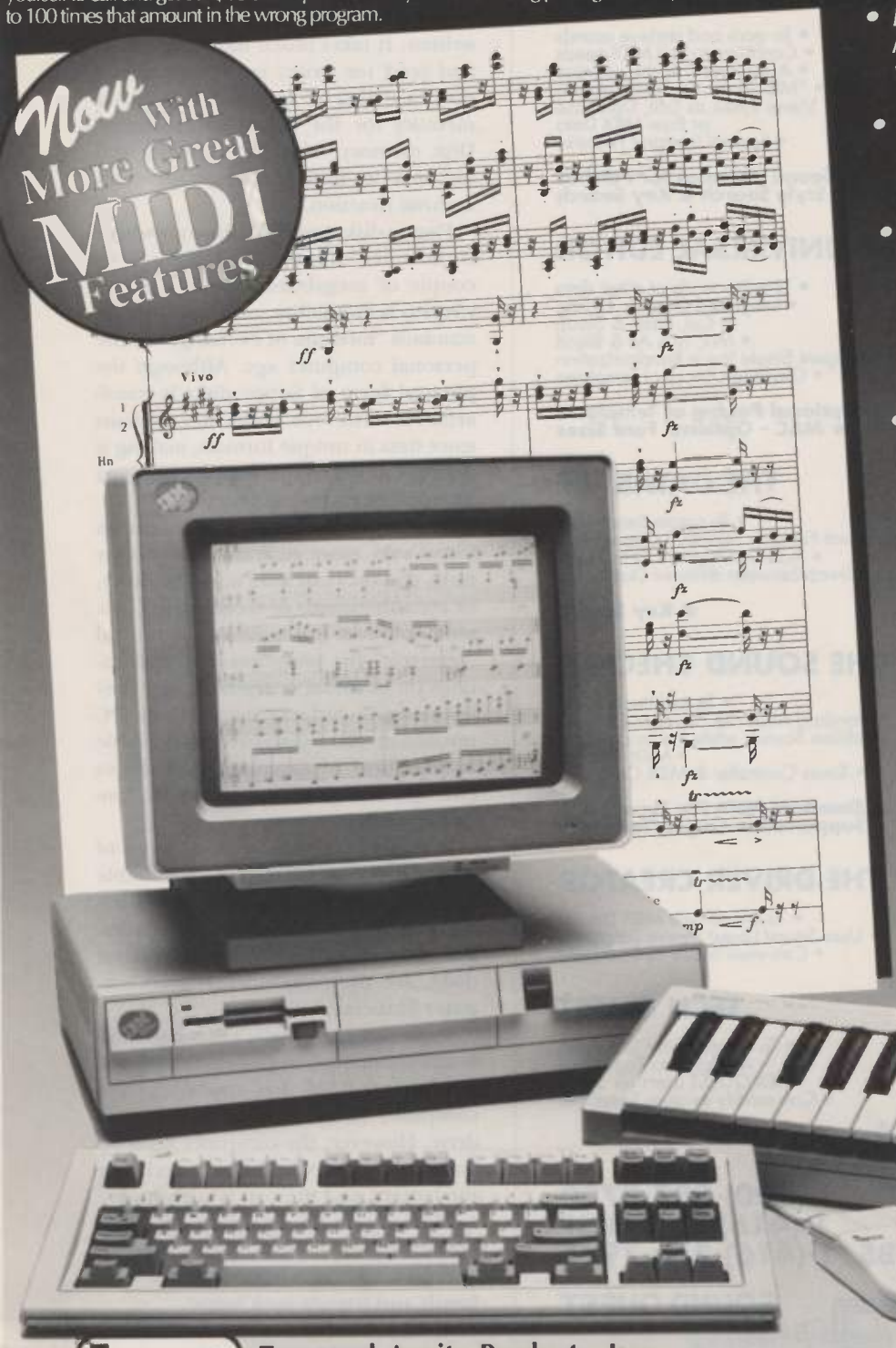

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interconnected. Once the last pattern is laid down, the wafer is sawed into individual "chips," and these are wired into the packages we see when we look at the circuit boards inside our equipment.

OFF-LINE STORAGE

Computer tape, floppies, and hard disks are nonvolatile forms of storage. All store information through magnetic charges that last until the medium is physically damaged, or the data overwritten. It takes much longer to locate and read (or write) information on a disk, so data is brought into RAM memory for the actual computation. Disk memory, with its durability and low cost per unit of storage, serves an archival function.

Floppy disks generally store anywhere from a few hundred kilobytes to a couple of megabytes. Their principal virtue is removability , making them the standard "medium of exchange" of the personal computer age. Although the physical form of floppy disks is standardized, different computer systems store data in unique formats, making it difficult to exchange floppies between different computer systems.

Hard disks are bigger, faster, and in some ways more delicate than floppy disks, and they can hold tens, hundreds, or even thousands of megabytes. Their most common use today is as a central "reservoir" for programs and applications on personal computers, and they have contributed enormously to the PC revolution. Hard disks are also available in the form of removable cartridges (though at higher cost and more limited capacity).

In the last few years, various forms of optical disk drives (including removable versions) have become available, offering still larger data-storage capacities. For more about hard disks and optical disks, see the November 1990 "Computer Musician."

Some companies now sell boards and boxes containing large amounts of battery-backed RAM that appears to the computer as an extremely fast disk drive. However, the computer must be powered up every few days to recharge the battery, and the cost is fairly high.

This concludes our memory tour. Please visit our sidebar on your way out and pick up some buzzwords for your family and friends back home.

David (Rudy) Trubitt *is the new sound reinforcement editor for* Mix *magazine.*

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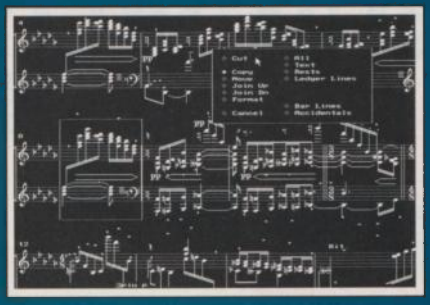
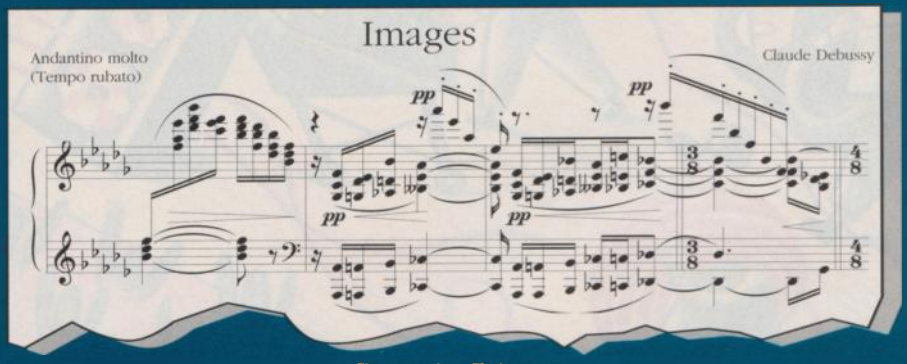


Main Score Editing Screen

Requirements: IBM 386, AT, PC, PS/2, PS/1 or compatible; VGA, EGA, CGA, or Hercules monitor; 640K memory; hard disc. Standard printer support: Epson FX/LQ; IBM ProPrinter; DeskJet and InkJet. Professional-DTP also supports LaserJet Plus/Series II, HPGL Plotters, and Postscript printers.



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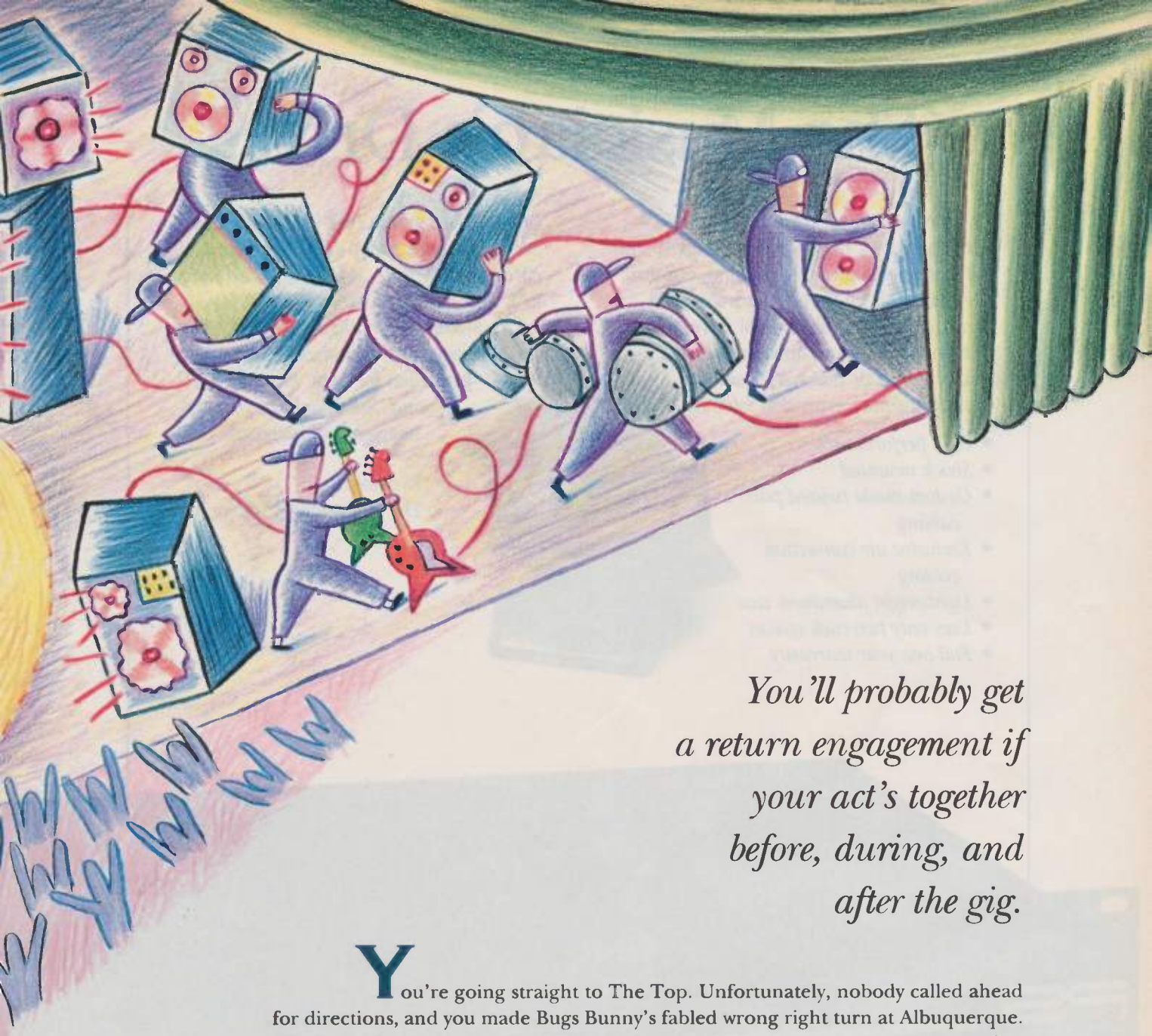
MAKING

BUD PEEN



You'll probably get a return engagement if your act's together before, during, and after the gig.

You're going straight to The Top. Unfortunately, nobody called ahead for directions, and you made Bugs Bunny's fabled wrong right turn at Albuquerque. When you finally get there, your load-in looks like something Mack Sennett wishes he'd thought of. Your setup is a perfect example of redundant effort, and as if this weren't enough, you miss cues all night because the Jolly Green Giant playing bass keeps getting between you and the lead vocalist, who cues everything with her butt. Music is a fun and fulfilling career.

It is a painful paradox that writing and playing music are two activities that require non-linear thinking, while managing logistics of a performance demands relentlessly linear thought. But there you are. Although the stereotypical musician cannot accommodate both left- and right-brain thought, we believe **EM** readers are a new breed of musician that can. So here is a collection of ideas intended to help you avoid repetitions

THE GIG

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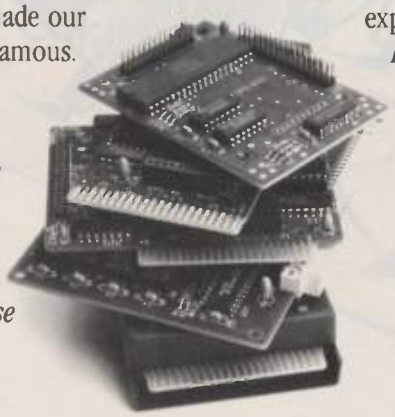

Our SCSI Rackmount Disk Drive System is compatible with *Akai S-1000, Dynacord ADS, EMU Emax II, E III, Mac SE/IICX, Ensoniq EPS, EPS 16 Plus, Roland W-30, S-550, S-770, Soundtools by Digidesign* and others . . .

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of what we generously call, "The Debacle at The Top."

The most basic tenet of getting your act together is organization. A good approach to attain this lofty goal is SAM, or Systemize, Adapt, and Modularize. Systemization should occur at every level. Find systems that work for your setup and then stick to them religiously. In the real world, however, things change. You must be prepared to adapt your systems and your setup on a moment's notice to accommodate the inevitable changes.

Perhaps the most valuable tool in making your systems adaptable is modularization. When things are broken down into small chunks, it is considerably easier to shuffle the chunks, yielding a system with built-in flexibility.

With the SAM concept firmly planted in our little brains, let's use a before-during-after approach to determine what methods of organization promote efficiency and general grooviness in the rather dodgy enterprise known as "pulling off the gig."

BEFORE THE GIG

Anticipate your needs and then make plans that meet them. Also, document everything. To do this, set your entire system up from scratch, at home. As you set up, devise the most logical and efficient order in which to do it. Basic setup consists of cabling and physical layout (unpacking components and placing them where they should be). AC power, audio, and MIDI are the three cabling subsystems you most likely have (other possibilities arise if you use a computer onstage, or carry a lighting system).

How you lay out equipment in your system depends on how it is packaged and how you use it. Make a list of what equipment you need to rack-mount and consider the most logical way to group equipment. It might seem easiest to have one rack for all your rack-mount equipment, but if that includes a few sound modules, a few outboard processors, a line mixer, and a small amplifier, you could end up with a rack so heavy you can't move it yourself. Avoid that situation; the modularity of multiple smaller racks yields greater latitude in placement (from the standpoints of accessibility and minimal blockage of sightlines) and accommodates changing needs. My largest outboard gear rack is eight spaces.

A logical structuring places equipment of similar function in the same rack because it makes for simpler cabling. With planning, you can lay out racks of synth modules or outboard processing such that most of the wiring is permanently set up within the rack, requiring you to connect only a few external cables at the gig. If you use a lot of electronic gear, thoughtfully placed, rack-mounted audio and MIDI patch bays help minimize unnecessary cable runs.

Be sure there is sufficient ventilation for any equipment that tends to run hot. It is worth leaving an empty rack space above such equipment to prolong its life and facilitate trouble-free operation. Avoid putting pieces that can emanate electromagnetic or RF garbage, such as a power amplifier or digital synth/processor, immediately next to a piece that has a lot of audio gain stages, such as a mixer or preamp. Finally, keep in mind that equipment may need to be taken out and put into the rack at various times. If you need to reach the racks to adjust things during the show, position them at a convenient height and accessible place. If one keyboard serves as a master to the whole system, and all your patch and parameter changes can be made from there, you can locate the racks in a more out-of-the-way spot (although you should never place equipment somewhere totally inaccessible during the show).

In terms of construction, a rack must accommodate its load. Amplifiers are quite heavy; thus, an amplifier rack must be made with much heavier wood, rear supports for the amps, extra strong and solidly mounted rack rails, heavy-duty wheels, and strong handles. A 4-space rack for sound modules or outboard gear, on the other hand, can be made with lighter plywood, no wheels, etc. In many cases, such a rack also can be shallower than an amp rack. If you fly your equipment regularly, use shock-mounted racks. These are considerably larger, heavier, and more expensive than standard racks. If you fly only occasionally, try standard racks and a padded outer case that is used when you fly. Several smaller racks can fit into one large, tray-and-cover-style, padded rack, which also can have wheels.

PLANNING A CABLING SYSTEM

Although physical layout varies with each person's collection of equipment

and working style, cabling is a critical parameter that all electronic (or even electric) musicians must face. In addition to having cables with proper connectors, make sure your cables are the proper length. There is no need to use a 15-foot cable to connect two pieces of gear in a rack, for example, but it is advisable to keep some slack in case something has to be moved unexpectedly. Carrying spare cables gives you choices and backup capabilities.

Make an inventory of your cables and be sure they are clearly marked. One or more stripes of colored vinyl or cloth tape are typically used to denote ownership. Numbering cables with cloth cable markers (available from electronics stores) allows you to easily trace a cable just by finding the other end with the same number. You also can organize your system's cabling by correlating cable numbers with function (cable 4 is the send to the reverb, cable 5 is the reverb return, etc.) and number the input and output to which a given cable is supposed to connect.

When you finally get everything laid out and cabled, it's time to make the cabling look clean. You can neaten things by bundling cables that run from the same source (or closely located sources) to the same destination, or by using a snake. Aside from the economic issue, bundling or using a snake (a single cable containing some number of conductor pairs) comes down to a question of permanency and layout. A snake is the cleanest way to go, and you can gain some amount of flexibility in using snakes by making harnesses. A harness is a short group of bundled cables dedicated to a single piece of equipment.

In onstage setups, things are subject to change, making bundling a better choice. Bundling cables consists of making a mock snake by wrapping some sort of tie around a group of cables at regular distances, maybe every few feet. Standard cable ties, once applied, only can be removed by cutting them off. Removable ties are available but more expensive; a more economical, if physically weaker, alternative is plastic garbage bag ties. (Metal ones stick you and cause short circuits.) If you apply tape to keep bundles or snakes in place, wipe down the cables periodically to remove leftover glue. Warm water with mild soap works well for this job; isopropyl alcohol only should be used as a last resort, as it tends to dry and crack plastic and rubber.

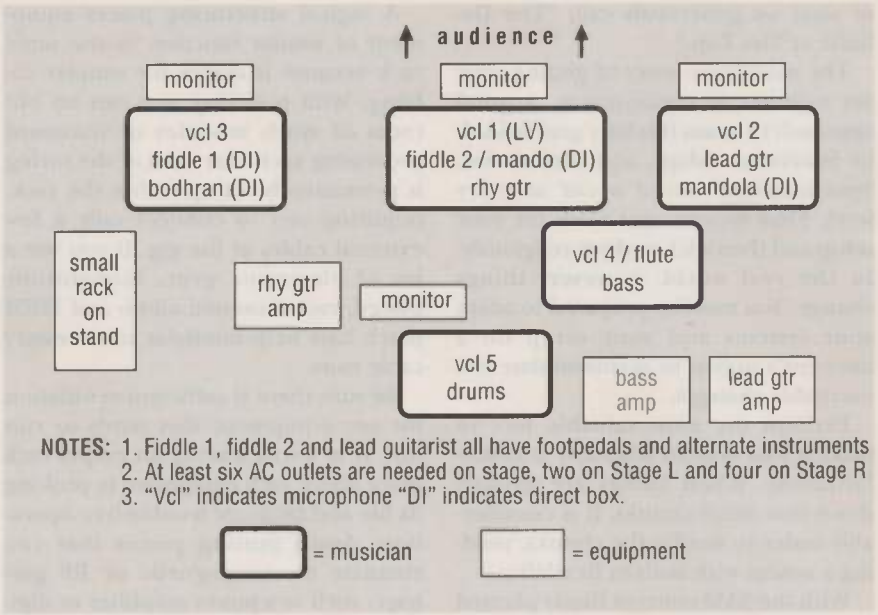

FIG 1: A stage plot shows the locations of performers and primary equipment.

Rack wiring should be especially neat. To avoid induced noise in the audio, bundle and run AC and MIDI cables to one side of a rack and audio cables to the other side. Maximum speed and convenience in connecting a rack to a mixer comes with the use of multipin connectors. With a multipin connector mounted at the rack and one at the mixer, it only is necessary to take a snake terminated in multipin connectors and slam it in at each end. At the mixer end, the multipin may be wired to a patch bay, or hardwired to mixer inputs and outputs. Although this is a fast and easy method, multipin connectors are expensive and require considerable wiring effort.

Once your system is fully cabled, power it up and see how it sounds. Now is the time to find and eliminate any problems in your system. Try to create a coherent ground scheme, especially in your racks, and stick to it. A common problem in clubs is that different circuits often are used for the sound system amplifiers (located at the stage) and the mixing station. The stage equipment may be on yet a different circuit. There is great potential for ground problems, but it is best to avoid lifting third-pin grounds as much as possible. One conundrum here is that the mixer, as the central connection point for everything, seems the ideal ground point (assuming that the mixer even has a third-pin ground or ground lug). A connection scheme of this sort often implies lifting the third-pin ground on the system's power amplifiers to get rid of hum. With the power amps carrying large amounts of current, this makes a small number of cable shields the only safety grounds for the amps, which could be dangerous. Balanced connections between the mixing station and the amps leaves you more options for eliminating hum while maintaining safety grounds. (For more on dealing with AC power in live performance, see "Performance Power" in the May 1990 EM.)

DOCUMENTATION

Professional touring acts have a technical rider to their performance contract that specifies their technical and onstage logistical needs . You need one of these, too, even if you're not touring. What's in a technical rider? First of all, a stage plot (see Fig. 1), which is a diagram that shows where everybody stands and where primary pieces of equipment—instrument amplifiers, keyboard setups, drums, outboard racks, etc.—are located. Including some symbol representing desired locations of AC outlets and power requirements (how much current is that amp going to draw when you're really cranking?) helps, as does some indication of required stage size. The stage plot can be a fairly simple graphic and doesn't have to be absolutely precise or to scale, but it must be legible and accurately represent the relationship between objects and

Jonathan Cain of The Babies, Journey & Bad English Album: "Bad English" (Epic)
"Analog, Digital, to Special Effect; if you're looking for any sound Voice Crystal has them. Just listen to our #1 Bad English Album, Voice Crystal sounds are all over it."

Keith Emerson
Emerson, Lake & Palmer and "3"
Album: "To the Power of 3" (Geffen)
"Pioneering (the first portable?) Moog Synthesizer console in '69 proved a demanding feat. Towering to 7 feet, a ladder was sometimes necessary to change patchcords. It also weighed approx. 1 ton. The road crew hated me. I now carry a Voice Crystal in my top pocket, got rid of the ladder, and my road crew loves me."
Cheers,

Russ Freeman
The Rippingtons
"A lot of sounds out there are interesting, but the bottom line is; can you make records with them. With Voice Crystal cartridges you can. I'll definitely be featuring some of the sounds on our next GRP Rippingtons Album, 'Welcome to the St. James Club.' Thanks for making synth programming easier!"
RUSS FREEMAN

Rob Mullins
Album: "Tokyo Nights"
"Voice Crystals give the musician the best sounds for both the live and studio situations. It is simply the best sound library on the market."
ROB MULLINS

Voice Crystal™

Jan Hammer
Miami Vice TV Show and many Movie sound tracks.
"I use Voice Crystal patches because they are the most musical in their character. They fit my ideas like a glove."

John Lawry
Keyboards for Petra
Album: "Beyond Belief" (Word)
Solo Album: "Media Alert" (Word)
"Great sounds for the working musician."

Troy Luccketta Drums for Tesla
"I do the drumming for Tesla, but when I write music, I use the Voice Crystal sounds."

Tom Coster, Tom Coster, Jr.
Album: "Did Jah Miss Me!?"
"With touring, studio work, and teaching, there just isn't time for programming, so I rely heavily on outside sources for sounds. Voice Crystal provides me with the sounds I need. The sounds are musical, contemporary and available for all my keyboards. Voice Crystal has truly become a powerful 'voice' for my music."
formerly of Santana

Larry Oakes Keyboardist/Guitar for 1988 Foreigner Tour and 1989 Bad Company Tour and Gold Album: "Dangerous Age" Lou Gramm
"Voice Crystal sounds are fat and meaty, just the way I like 'em. Whether duplicating or originating their superior quality is always inspiring."

Marc LeBrun Keyboardist/LA Session Player on Tour with Diane Schuur & Tom Jones
"Whether I'm playing in the studio or live on stage Voice Crystal makes my keyboards sound great!"
Marc LeBrun

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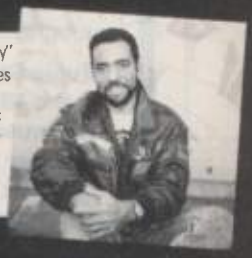
Gene Sisk Keyboardist for "Eddie Rabbitt" Country Western artist; #1 Country Western Album on Billboard Charts (Capitol Records)
"Voice Crystal has the sounds I want to hear, and the sounds I want to create."

Kevin Gilbert Keyboardist for Giraffe
1988 Yamaha Sound Check Winner
"Having a vast library of sounds this good allows me to focus on my songs."

Bobby Lyle Album: "The Journey"
"The new Voice Crystal cartridges give me a whole new array of dynamic sounds to color my music with. I'm looking forward to making them an intergral part of my sound for the 90's."



Steve Reid Producer/CBS Records
The Rippingtons and Super Tramp
"One of the most demanding things about producing is finding the right new sounds for each project. With Voice Crystals I've found an endless variety of fresh sound for my synths and samplers. Keep it up guys!"

Mark Stich
Keyboardist for Angela Bofill
Album: "Angela Bofill/Intuition" (Capitol)
"I was given only a few weeks to prepare for the 1989 Good Friends National Tour. With no time for programming my own sounds, I turned to Eye & I Productions and Voice Crystal sounds. From Fat Analog sounds to complex Digital Timbers Voice Crystal really came through for me. Thanks Guys."

Terry Wollman Music Director for The Byron Allen Show Nationally Syndicated, NBC, CBS, ABC TV
"Working with Voice Crystal gives me a spectrum of sounds to choose from and leaves me free to compose and play music."

Freddie Ravel
Keyboardists for Sergio Mendez & RAVE'L
Album: "Midnight Passion" (Polydor)
"I use Voice Crystal because they bring new life to my synthesizers and samplers."
Album release Jan. '91

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PRODUCTIONS, INC.

MARK L. WIENS, President • PAUL D. CHASTEEN, Vice President

people onstage.

Next, create an input list (see Fig. 2) that states how many inputs you need on a snake and mixing console. A good input list is in a logical order, generally the one preferred by the sound mixer (if you have one). It is also good to indicate, for each input, whether the signal source is a microphone, direct box, or line-level input. Use the stage plot and input list to solidify your organization and train roadies; or, they can be sent to venues or sound companies when you don't use your own sound system on the gig.

Make a block diagram of your onstage audio system (Fig. 3), showing which gazoutas connect to which gazintas and indicating the connectors used at each input and output. Next, make another block diagram of your MIDI system; you don't need to indicate connectors, but you should note the MIDI channel on which each piece operates.

You would be wise to create documentation for all the other systems that you implement. You can refer to it if you forget something, use it to convey to others how your stuff is set up, and get a clear perspective from which to improve your system. Make multiple copies of each piece of documentation and collect them in notebooks so you can carry one notebook to the gig and leave one safely at home.

Every gig should be "advanced" well before the performance date. When booking a gig, obtain in writing contact information for everyone involved in the gig (venue, sound company, promoter, other performers). Gather some of the information when you call: directions to the venue, availability of parking, the time when you can get in to start setting up, details of the load-in logistics (Are there stairs or a direct entrance to the backstage area?), the size of the venue, the size of the stage, and details of available AC power (How many circuits and outlets are there and where are they located?). Tell them about your needs and, if called for, arrange to send your technical rider. When possible, visit the venue in advance of the performance date to familiarize yourself with the logistical details. This also allows you to meet some of the house staff and establish a friendly relationship, as well as foster in them an impression of your professionalism.

SMALL VENUES

INPUT	PLAYER
1	Player 1 voc (mic) *
2	Player 2 voc (mic)*
3	Player 3 voc (mic)*
4	Player 4 voc (mic)*
5	Player 5 voc (mic)*
6	Player 3 fiddle (DI)*
7	Player 1 fiddle/mandolin (DI)*
8	Player 2 mandola (DI)*
9	Player 3 bodhran (DI)
10	Effects return (at mixer)

LARGE VENUE OR BROADCAST

INPUT	PLAYER
1	Player 1 voc (mic) *
2	Player 2 voc (mic)*
3	Player 3 voc (mic)*
4	Player 4 voc (mic)*
5	Player 5 voc (mic)*
6	Player 3 fiddle (DI)*
7	Player 1 fiddle/mandolin (DI)*
8	Player 2 guitar (mic)
9	Player 1 guitar (mic)
10	Player 2 mandola (DI)*
11	Player 4 bass (DI or mic)
12	Player 3 bodhran (DI)
13	Player 5 kick drum (mic)
14	Player 5 snare drum (mic)
15, 16	Player 5 drum over L/R (mics)
17	Effects return (at mixer)

* = Can be provided by the band.

FIG. 2: An input list helps you plan snake and console wiring.

ON THE ROAD AGAIN

Now you have to get packed and go to the gig. As with setting up, tearing down the equipment should be a systemized process. Pack fragile objects (such as acoustic instruments) and things small enough to disappear easily first. Then tackle cables (learning how to properly coil cables will noticeably prolong their life). Finally, pack large objects. Equipment should be logically grouped: cables in one case, small boxes such as outboard power supplies or MIDI thru boxes packed together, etc. Experiment to obtain the most efficient pack; often the best use of space is the safest pack because there is little room for things

Feature Shock!

A built-in tape timer displays current tape position in hours, minutes, and seconds, and includes a search-to-cue locator with cue point and zero location memories.

Otari's new MX-50. Built around the premise that you can have everything you ever wanted in a two-track tape machine, and still stay within your budget. For example:

The Transport

—DC quartz PLL capstan motor with front panel selection of operating speeds (from either a 15/7.5 or 7.5/3.75 ips speed pair).

—Capstan speed variable by ± 7% from the front panel, and by ± 50% from SMPTE time-code external controllers via an Otari-standard 37-pin connector.

—Optional remote control.

The Electronics

—Lighted VU meters with peak-reading LED indicators.

—Transformerless active balanced inputs with XL-type connectors.

—Optional Voice Editing Module (VEM) for twice normal play speed with normal pitch.

Otari's MX-50. For whenever or wherever you need a *professional* audio machine at an affordable price.

For more information, call your nearest Otari professional audio dealer, or Otari Corporation at (415) 341-5900.

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10.5" reel size capacity with self-centering NAB hub locks.

± 7% vari-speed.

Capstan speed controllable ± 50% via SMPTE time-code external controllers.

Optional Voice Editing Mode (VEM) for twice normal play speed with audio pitch shifted down one octave for normal pitch.

Alloy deckplate.

Lighted VU meters with peak-reading LED indicators.

Headphone amplifier with front-panel headphone jack and level control.

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DC quartz PLL capstan motor with front panel selection of operating speeds.

Independent reel size selectors for supply and take-up motors.

Built-in tape timer display.

to move around in transit. When you pack several things in a case, put foam padding on top of front panels to prevent getting bent sliders and broken switches. Avoid soft cases; they afford little protection. If you're really in a financial bind, you can find suitcases from thrift stores and pawn shops at bargain-basement prices.

Don't forget your documentation: As you pack a case, make a list of what it contains and try to pack that case the same way every time. When everything is packed, make a list of all the cases and objects that constitute your rig. Touring pros often use stencils to spray-paint functional markings ("house mix," "fx 1," etc.) as well as ownership identification on cases. Use these lists as checklists every time you travel to a performance.

A word about roadies: Obviously, find people you trust; be wary of unfamiliar volunteers, lest someone liberate your equipment. Most roadies are not professionals, so go over basics with them beforehand. Make sure the "chain of command" is understood (who is responsible for what, who can answer their questions, etc.). Show them proper methods for lifting and carrying, and emphasize that it is unacceptable to play "macho" by trying to deal, single-handedly, with large, bulky items. Then show them your documentation and setup procedure. Finally, remind them that, whether they are paid or not, their job requires caution, and mind- or mood-altering substances may hinder their ability to work safely.

As with packing equipment into cases, it is best to evolve a system for packing your vehicles. There are many considerations, the most obvious of which is weight-loading: Make sure no vehicle is loaded with more than it can comfortably carry. Be sure to properly distribute weight. Place the heaviest items as low as possible and just behind the front axle. This keeps the center of gravity low and the primary load distributed where the front and back suspensions share the work. Try to have complete systems travel together; that is, place the whole sound system in one truck, all the drums in the same vehicle, etc. This simplifies tracking equipment and load-in. With everything packed, make one last look inside to spot anything that was forgotten, then use your checklist to quickly check the contents of the vehicles and make sure it's

Take Control

When factory presets alone are just not enough. When you know it's time to exercise more control over the sound of your music. Move up to **MIDIVERB®III.** The powerful simultaneous multi-effects processor that's the latest incarnation of the award winning* MIDIVERB from Alesis.

We know better than anyone else **how** to make great sounding digital effects. **That's** why MIDIVERB III has 200 **programs** in 16 bit stereo with 15k**Hz ba**ndwidth. And features the kind of pro-grammability you need to create powerful mixes. All this and 4 effects at the same time make MIDIVERB III the first choice in digital processing.

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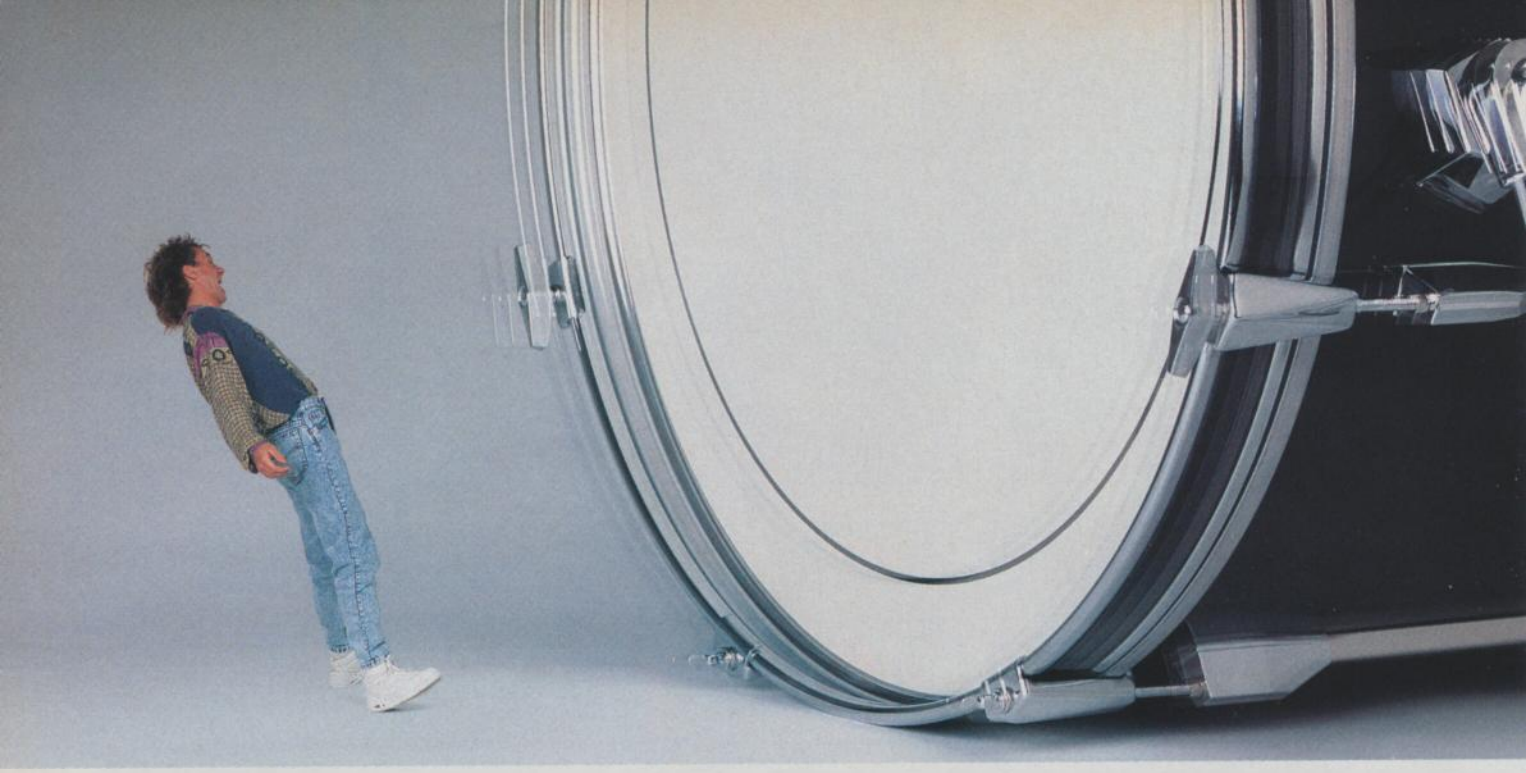

MAXIMUM IMPACT.

E-mu's new Procussion™ Maximum Percussion Module doesn't do anything in a small way.

Over *1000* drum and percussion sounds based on 16-bit samples from the Emulator™ III library flawlessly reproduced by our celebrated G-chip. Each one too big, too hot, too real to be described by words.

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So put yourself in front of Procussion. Crank it up. Then brace yourself for maximum impact.

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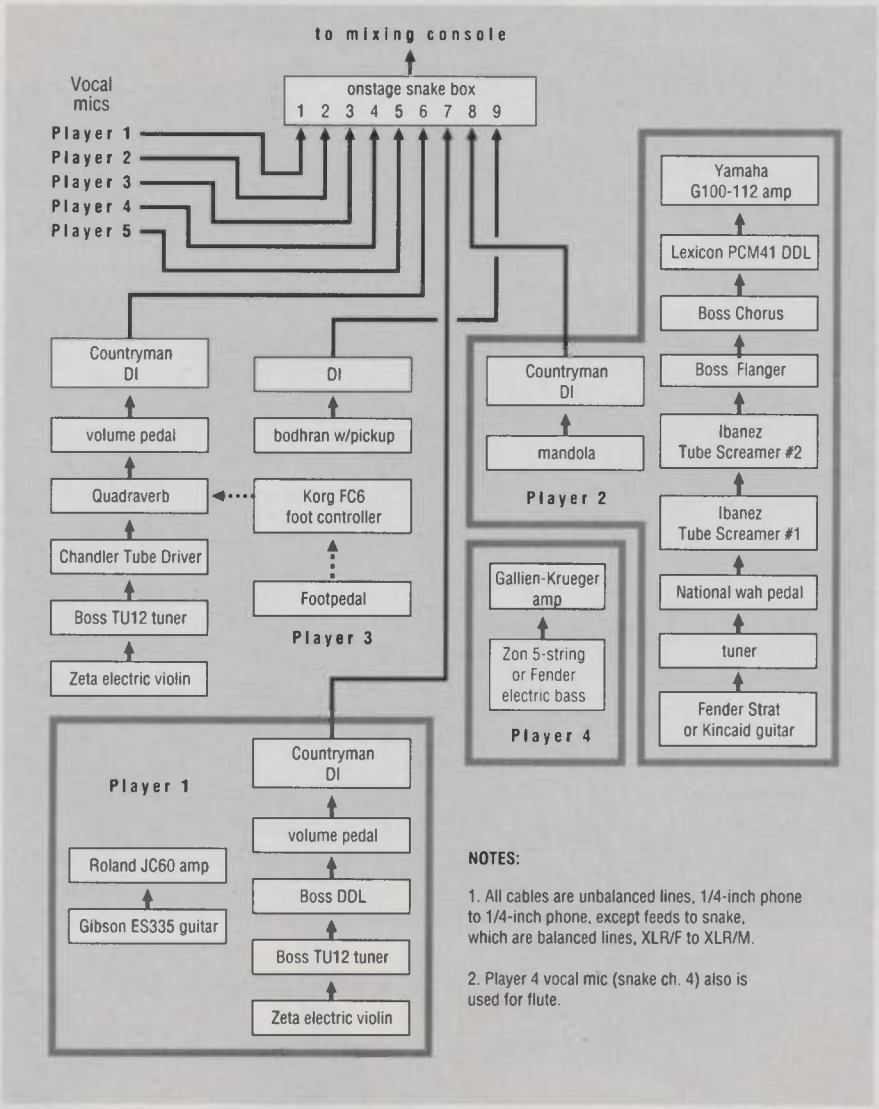


FIG. 3: This block diagram not only displays signal flow, but locates DI boxes and identifies what type of connectors are required.

all there.

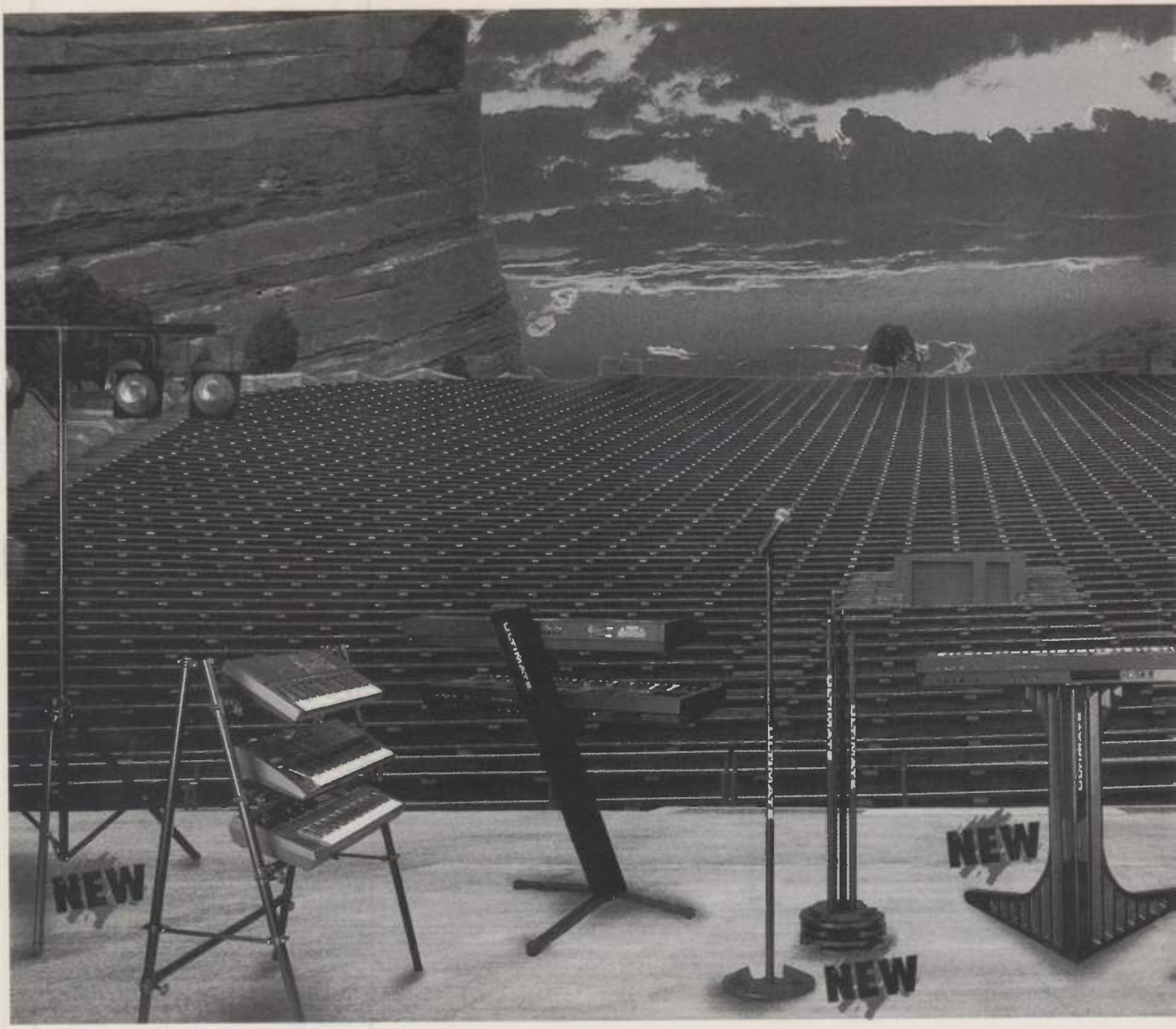
When traveling, use at least two vehicles in a caravan; that way, if one breaks down, you're not all alone and blue. CB radios can be a life-saver for hard-core road warriors concerned about keeping caravans together.

LOAD-IN

When you arrive, enter the venue and check out the scene before unloading anything. Look at load-in access, stage size and location, and location of AC outlets, and check the size and layout of the club from the standpoint of deploying speakers and setting up a mixing station. Then, start unloading. One system places a person inside the vehicle, handing out equipment, and another inside the venue, directing where things should be put.

As equipment is brought in, it is best to place it somewhere close to where it will be used. Once the equipment is inside and vehicles are properly parked, place the largest components, i.e., house speakers and amplifiers. Since stage height usually is below audience ear height, place speaker cabinets and instrument amplifiers off the ground, even if only by a few feet. Ideally, the high-frequency components of the speaker system should end up just above audience ear level, about six feet off the ground on which the audience stands.

Before plugging in anything, take a simple AC tester, available at any hardware store, and check all the outlets you intend to use to make sure they are properly wired. If not, don't use them and speak to the management: Blowing



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off a gig is better than blowing one up.

Unless you use a very basic sound system, the sound system will take longer than the individual stage setups to put together. Therefore, place large components first, then divide the labor. Assign one or more crew members to set up the sound system while the performers (and any leftover crew members) do their stage setup.

Avoid aiming speakers directly at reflective surfaces such as windows, and avoid placing speakers immediately next to a table or right in the ears of the audience. In short, coverage and fidelity are the primary criteria in determining optimal speaker placement. In the real world, though, there are also logistical considerations: There may be only one place you can put the speakers, forcing you to figure out how to maximize coverage and fidelity in that location.

Another logistical concern is placing speakers where they don't affect audience members' activities. When possible, secure speakers that are stacked or not at ground level. After placing the speakers, find a spot for the sound system's amplifiers where they will be out of the audience's way yet reasonably accessible to the crew in an emergency, and close enough to the snake's stage box and the speakers for easy cable runs.

The next job in setting up the sound system is to run the mic snake from the stage to the mixing station. The stage box of the snake should be placed where all the microphone and direct feeds can reach it with the least amount of cables running across stage, and where returns from the mixing station can reach to the amplifiers. (The optimal location for the stage box often turns out to be directly in front of the kick drum.) To avoid interfering with audience movement, run snakes along the wall of the room from the stage to the mixing station.

STAGE SETUP

The stage setup, i.e., the positioning of the performers, is important for both functional and cosmetic reasons. Consider how the audience sees the band. Make sure featured performers are clearly visible and the audience's view is balanced. Balance the number of people on each side of the stage, the amount of equipment they have, and their physical characteristics.

From a functional standpoint, the stage setup should allow a sonic balance between onstage sound sources. There also should be some amount of musical adjacency: The bassist and drummer should be next to each other, as they are the core of the rhythm section. Then there are sightlines. Performers should be both visible to the audience and able to see each other. Furthermore, there must be clear sightlines between the performers and the sound mixer, especially the monitor mixer (who, in clubs, is often the house mixer). The entire band's setup must be behind the line of the house speakers to avoid feedback problems.

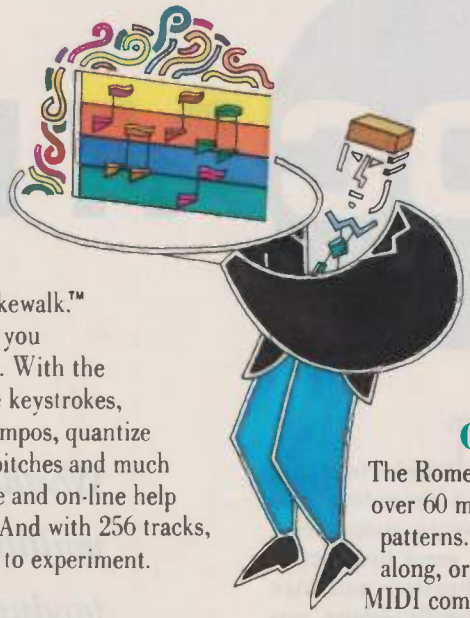
If someone in the band mixes from onstage (a common, if decidedly undesirable, scenario), the entire issue of locating the mixing station is moot. If, however, there is a sound mixer, the mixing station should be located in a spot from which the sound is representative of what the audience hears, which is to say, at least somewhat on-axis to the speakers. As often as not, the layout of the venue and the rules of the proprietor are the factors that limit placement of the mixing station. Ideally, the mixing station stands in the lateral center of the room, about two-thirds of the way towards the back.

At the mixing station, the engineer must be careful to locate racks for convenient access, without significantly blocking the audience's sightlines to the stage, or affecting the sound reaching the engineer's ears (i.e., avoid locating them at ear level and in close proximity).

Completing the stage setup requires placing monitors and microphones and cabling the whole mess. Slant monitors, the most common variety, are meant to throw a fairly short distance (ten or fifteen feet at most) and be pretty directional. They should be placed several feet in front of the performer, in a spot where his/her microphone has maximal rejection, with the high-frequency driver aimed at the performer's head. Sidefill monitors, used on larger stages, must be placed even more carefully to avoid feedback. Evaluate the location of the nearest microphones and try to minimize bleed from the sidefills into them. (For more on stage monitors, see "The Essential Stage Monitor" in the May 1990 issue.)

(continued on p. 123)

Play It. Stretch It. Squash It. Clone It. Loop It. Punch It. Patch It. Drag It. Zoom It. It's A Piece Of Cake.



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RECORDING

LIVE ON LOCATION

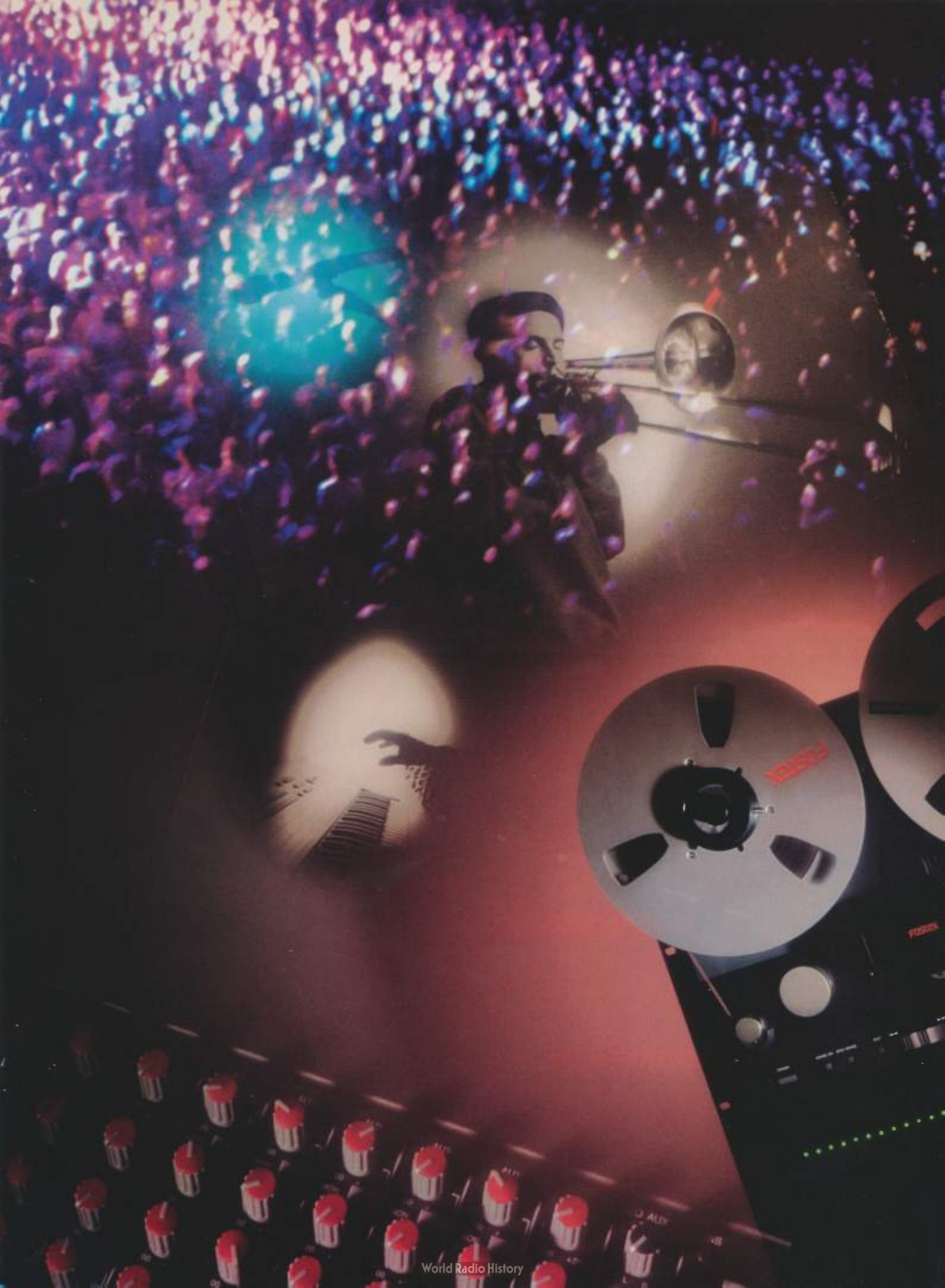
Whether 2-track or multitrack, producing quality live recordings requires smart use of your equipment.

There's something magical about a recording that captures the energy, spontaneity, and sizzle of a great live performance. The cheering audience heightens the band's playing, creating a special ambience that no studio performance can hope to match. While such a scenario is every musician's dream, the art and science of live recording is fraught with pitfalls that can make the pursuit of the ultimate live recording a difficult quest.

Of course, if money is no problem, then things can be simple. Pick up a copy of the March 1991 *Mix* magazine (our sister publication), peruse the directory of remote recording companies, and choose a 32- or 48-track digital remote recording truck to follow your next tour and get all those hot licks down on tape. Select your favorite performance cuts, overdub to fix the occasional flat vocal note or instrumental clam, spend a couple of months mixing the tracks

By George Petersen

ROB CARDIN



IT'S REAL. IT'S AFFORDABLE. AND IT'S AVAILABLE RIGHT NOW.

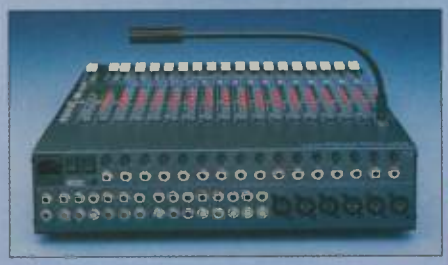
From the man who virtually invented high-quality, high-value portable mixers almost twenty years ago comes the definitive design for the Nineties.

Not another "me-too" addition to a product line, but a totally integrated 16-channel system from the company that specializes in mixers.

Greg Mackie set out to develop the most flexible, feature-packed, practical and expandable mixer ever. Those who already own CR-1604's tell us that he's succeeded and then some. Moreover, they say it SOUNDS superb.

LOW NOISE AND HIGH HEADROOM.

They aren't mutually exclusive anymore. The CR-1604 gives you 90dB working S/N and 112dB dynamic range. In every circuit stage, we've concentrated on improving noise performance . . . and then preserved these improvements through a new gain structure topology. At the same time, the CR-1604 also gives you **two times more headroom** *than old-style mixers — where it counts, in the critical mix amp stage.*



INTELLIGENT EQ POINTS.

Because we so unflinchingly scrutinized "features" others take for granted, the CR-1604 delivers many un-typical but refreshingly useful differences. Like equalization centered where it's most musical: Bass at 80Hz (not 100Hz), midrange at 2.5K (not 1K), and HF at 12K (not 10K). Small touches, but indicative of the thinking behind every facet of the CR-1604.

7 AUX SENDS PER CHANNEL.

You can simultaneously run a stage monitor mix, two reverbs, two digital delays AND a stereo recording mix, or . . . well, we're sure you can come up with your own uses for this many sends. To find out how we achieved this in such a compact design, get our detailed brochure.

PHANTOM-POWERED +48V MIC INPUTS.

Not just afterthought XLR's stuck on the back, but discrete, balanced microphone preamps as good as you get in a big console or one of those expensive separate boxes. Four conjugate-pair transistors with large emitter geometry reduce distortion at all levels, and deliver extremely low noise (our published spec –128 dBM @150 ohms is real and verifiable). Attach our XLR10 module to add 10 more MIC preamps quickly and economically.

THE ONLY DUAL-CONFIGURABLE MIXER.

Our moveable "connector pod" attaches two ways and changes in two minutes. When rotated to the back, the CR-1604 becomes a 7-space rack-mount mixer.

All connections except headphones are on the rear. Turn the pod 90° and you have a table-top mixer with just the right slope and quick, convenient access to all inputs and outputs.

MODULAR FOR EASY UPGRADE.

Because all input and output circuitry is contained in the CR-1604's pod, you'll be able to add specialized Mackie control modules later. Like a 16-ch. noise gate/MIDI mute, or perhaps full parametric EQ, automated MIDI mixing or 16-ch. noise reduction . . . Who knows? The mind boggles!

RUGGED CONSTRUCTION AND DETAILS THAT COUNT.

Greg Mackie brings 20 years of practical design and production experience to the CR-1604. So you can be sure it's no lightweight, physically or electronically. You get a steel chassis, **built-in** *power supply, double-redundant parallel-wired dual pots and environmentally-sealed rotary controls. It's reliable, roadable and backed by an unusually-long, confident warranty.*

FOR JUST $1099, MORE IS LESS.

The CR-1604's only flaw may be its price: Comments on warranty cards indicate some people think we're not charging **enough** *for this much mixer. But then, Greg Mackie's philosophy is that with the right attention to detail, quality and performance don't have to cost more.*

We've only touched on a few of the CR-1604's innovative features in this ad. For the whole story, call or write Doug Schauer for a detailed 6-page brochure and the name of your nearest Mackie dealer. Then check out the CR-1604's sonic performance and features for yourself.

Yes, this remarkable design is real.

And you can own one right now.

CR-1604

- 7 AUX sends per channel
- 4 stereo/8 mono effects returns
- Balanced main outputs (+28dB)
- +4 and -10 operation
- 8 direct outputs
- Inserts channels 1-8
- Studio-grade MIC preamps
- In-place stereo solo
- UnityPlus™ gain structure
- Less than 0.02% distortion 20Hz-20KHz
- Occupies just 7 rack spaces
- Connector provided for optional gooseneck lamp
- 3-year Limited Warranty

MACKIE.

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(preferably at a world-class studio in some exotic locale), and—after a few sessions of digital editing—you can come away with a seamless production that spotlights the best of the best.

Back to reality. First of all, in any but the rarest instances, money (or lack of it) *is* the most important consideration. Second, in any production, detailed preproduction planning is an essential element in controlling costs and insuring that the recordings sound as good as possible.

The first stage in planning is determining the intended use of the recordings. While this may seem obvious, your approach to making a live recording will vary considerably depending on whether you are making product for sale, creating a demo for prospective clients, or just want a reference copy so you and the band can listen to the show after the gig.

The selection of a site and date for the recording is critical to the success of the project. You may be courting disaster if you expect to do an elaborate multitrack recording on a night when your band is in the middle of a lineup with three other bands and can't do a soundcheck. One alternative is renting a club—perhaps on a "dark" Monday night or a Sunday afternoon—taking plenty of time to set up and check everything out, and then giving a showcase-style performance for an invited audience of friends and fans.

USING A STEREO MIC PAIR

There are probably a million different ways to make live recordings. Depending on who you ask, all of them are right, and all are wrong. The methods range from the megabuck superstar scenario described earlier, to an extremely modest setup. Paradoxically, one of the best ways of making a great live recording is also the simplest. Place two mics somewhere in the room and record the gig onto a stereo recorder (DAT, cassette, or 2-track reel-to-reel). The advantages of such a method are many: Costs are minimal, hassles are few, and the resulting first-generation tape is about as high-quality as you can get. This is a preferred method for recording classical and acoustic music concerts, and dedicated amateur recordists have produced thousands of top-notch tapes of Grateful Dead shows over the years using simple, relatively low-cost equipment. The bottom line is it works, and with the advent of portable DAT recorders, the process is getting easier all the time.

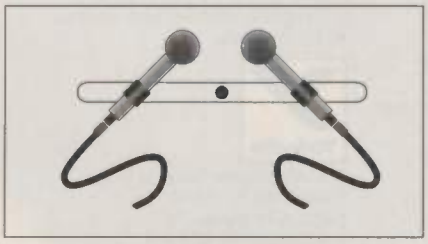

FIG. 1: The X-Y miking technique.

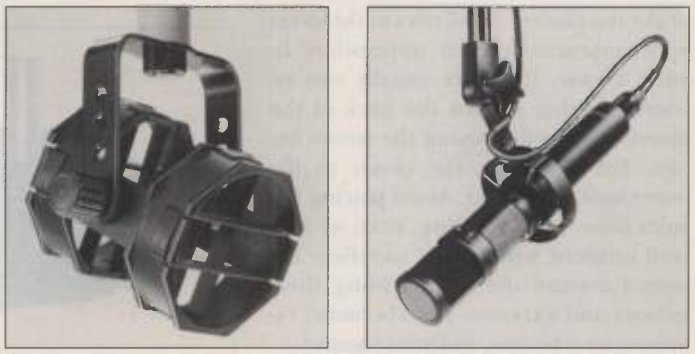

FIG. 2: Typical microphone shock mounts by Audio-Technica (left) and AKG (right).

When using one or two microphones to record a music performance from a distance, the actual placement of the microphones within the venue is a critical element in the quality of the recording. A pair of microphones that are widely spaced—say, more than ten feet apart—may provide a pronounced left/right stereo image, but can create difficulties such as the "hole-in-the-middle" effect, where sounds from the outer stage edges are emphasized while sounds emanating from the center are not picked up as well. Another problem with widely spaced microphone pairs is the time lag that occurs when sounds reach one mic much sooner than the other. This often manifests itself as phase cancellation, resulting in the loss of certain frequencies (usually bass and other low instruments) when the signals from the two mics are mixed, recombined, or played in mono.

One simple way to avoid phase problems is to place the mics in a coincident pair, where the microphone capsules are kept within a few inches of each other. One frequently used method, known as an X-Y pair, is shown in **Fig. 1**. The mic bodies are placed close together, with the mic on the right side pointed to the left and vice-versa. The angle between the mics can be increased or decreased, depending on the distance to the stage, the width of the performance area, and the desired amount of stereo separation. (The X-Y method also provides excellent results in closer applications, including drum overhead miking and stereo sampling.)

A little experimentation before the gig will help you determine what angles, mic-to-stage distances, and mic stand heights work best.

Regarding the latter, I usually mount mics on a lightweight, 10-foot, photographic lighting stand, which gives me a lot of leeway in terms of adjusting mic stand height. A tall stand is essential, and sometimes a standard mic stand with boom arm will suffice. It's nice to be able to keep your mics high enough to avoid picking up individual conversations, yet provide a good balance between audience ambience and the stage performance.

While we're on the subject of mic stands, another useful accessory is a microphone shock-mount (**Fig. 2**), which suspends the mic, using elastic or rubber materials, thus decoupling (isolating) the microphone from noise caused by stage or floor vibrations, foot stomps, or someone inadvertently bumping into the mic stand. To protect a stand from tipping over (particularly a boom stand at full height, supporting two shock-mounted mics), I always pack a couple 10-pound barbell weights, which can be placed around the main support tube, over the base of the stand (**Fig. 3**). These aren't elegant, or even high-tech, but they provide cheap insurance against disaster.

A good starting point in determining the proper stage-to-mic distance is to listen to the band playing a typical tune, with the house P.A. system at an average volume. While facing the center of the stage, stand at various distances, listening carefully to find the "sweet spot" that provides a balanced blend of the instruments playing onstage with the output of the P.A. speakers. Unfortunately, certain restrictions (such as seating requirements, audience sightlines, mic-cable access, or even overhead lighting fixtures) may

make the placement of mics at the sweet spot impractical, even impossible. In such a case, the mics usually can be moved farther toward the back of the room without destroying the stereo image, but generally, the closer to the sweet spot, the better. Avoid placing the mics close to the ceiling, rear, or side wall surfaces, which tend to reflect the sound around the mics, adding short echoes and excessive reverberance, resulting in a boomy, indistinct sound.

FIG. 3: Barbell weights used to stabilize a mic stand.

MIC SELECTION

A major factor in determining the quality of any recording is microphone selection. When distance-miking in a typical nightclub venue, directional (such as cardioid, hypercardioid, and supercardioid) microphones provide the best results. Try to avoid using vocal-type mics to record an ensemble, since virtually all P.A. vocal mics have a frequency response tailored to incorporate some sort of midrange presence boost. While designed to help a singer's voice "cut through" other instruments, this same presence boost can overemphasize midrange sounds (particularly guitar, drums, and synth) and make your recording sound harsh.

Generally, condenser mics offer better results when recording ensembles than dynamic microphones, and they provide improved high-frequency response. However, condenser microphones tend to be more expensive than their dynamic counterparts, are more fragile (the first time you knock over a mic stand with a condenser mic might be the last), and require some sort of power source, either internal batteries or phantom power. If your mixer or preamp doesn't provide phantom power, consider using mics with internal batteries, but be sure to keep spare batteries on hand for the gig. As an alternative, many companies make AC- or DC-powered, phantom power supplies, and a number of manufacturers offer rack-mount mic processing devices that incorporate preamps, phantom power, and even limiting and equalization in a single package.

Many microphone manufacturers—AKG, Audio-Technica, Beyer, Crown, Neumann, Sennheiser, Shure, Sony, and others—offer stereo condenser microphones that use a variety of stereo approaches. These microphones provide a convenient way to make stereo recordings in the studio, or in the venue, and can serve double duty as location stereo mics for sampling, as well.

Even if your recorder only has 1/4-inch (unbalanced) mic inputs, resist the urge to use such microphones to make location recordings. First, unbalanced mic cables tend to act like antennas and are highly susceptible to hum, radio

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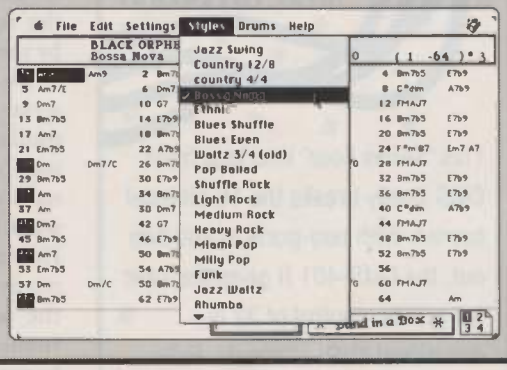

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frequency interference, buzzing, and noise (especially that caused by the SCR lighting dimmer systems used in most clubs). Second, the output signal from unbalanced microphones degrades noticeably when cables over twenty feet long are used. Offering a high degree of immunity to outside interference and the ability to easily run cable lengths in excess of 100 feet, 3-pin (XLR-type) balanced, low-impedance mics are really the only way to go in this situation. If your tape recorder doesn't have XLR mic inputs, you'll need to use an outboard mic preamp or mixer to increase the signal to match the levels required by the deck's line inputs.

We haven't discussed room acoustics so far, yet they play a vital role in determining the quality of any live recording. In classical music, the reverberant nature of the hall can add a wonderful warmth and fullness to the recording. However, when recording amplified music in a club, lounge, or large arena, the acoustical characteristics of the venue usually degrade, rather than enhance the performance, adding undesirable reflections from hard surfaces, resulting in a boomy sound that lacks intelligibility.

RECORDING FROM THE BOARD

One way to avoid the problem of room acoustics is to record a direct feed from the house P.A. mixing console. Contrary to popular belief, this method does not always yield great-sounding performance tapes. Remember that audience sounds or reactions (an important part of any live performance) may be barely discernible, or not heard, on a tape made from a direct "board feed." Also keep in mind that the board feed is meant to *augment* those sounds coming from the instruments on stage. In many cases (especially in smaller clubs), certain instruments—such as cymbals, bass, and lead guitar—are so loud that the sound engineer doesn't need to add much of these into the P.A. mix. In some instances, the board feed may consist only of vocals.

As a general rule of thumb, the "listenability" of the board mix (as a stand-alone entity) improves as the size of the venue increases. The sound quality of a board mix at a large outdoor concert (where poor acoustics are much less of a problem) can be truly spectacular. In small venues, the "listenability" of the board mix is inversely proportional to the onstage volume levels: Board mixes always sound better when stage volumes are kept at reasonable levels.

One of my favorite tricks is to record both the board mix *and* one or a couple of audience mics. I frequently record direct from the mixing board onto an EIAJ-format (Sony PCM-F1-type) digital converter (which records two tracks of digital audio on the *picture* portion of a VCR), while recording two audience mics on the Hi-Fi tracks. However, if you don't have a digital processor, this method also works with a 4-track recorder (reel-to-reel or cassette multitrack), or even a stereo deck. When using the latter, just record a mono board mix on one channel and an audience mic on the other. Don't feel you're losing out if you're only working with two tracks. Many P.A. mixes are done in mono anyway, due to audience seating arrangements and the wide separation of the speakers. Later, you can mix the tracks in any combination you desire to get the sound you want.

Another thing to keep in mind is that due to the relative slowness of the speed of sound, the signal reaching the audience mics is time-delayed by approximately one millisecond for every foot of distance between the mic and the stage. This easily can be corrected at the mixing stage by routing the recorded board feed through a high-quality digital delay line and adjusting the delay time to compensate for the difference.

The best thing about this method is that it can produce impressive results using simple equipment, yet provide a decent amount of creative latitude when mixing. The individual tracks can be equalized and/or processed with stereo reverb to suit individual tastes, and additional sounds—such as percussion bits, or sampled background vocal "oohs" and "aahs"—can be performed during the mix for additional sweetening.

WORKING WITH THE ENGINEER

One thing that cannot be overemphasized when dealing with any kind of remote recording is the need to interface with the house sound engineer at the venue where the recording will take place. The house sound engineer is your best friend: Treat him or her with kindness and respect, and things can go relatively smoothly. Without the

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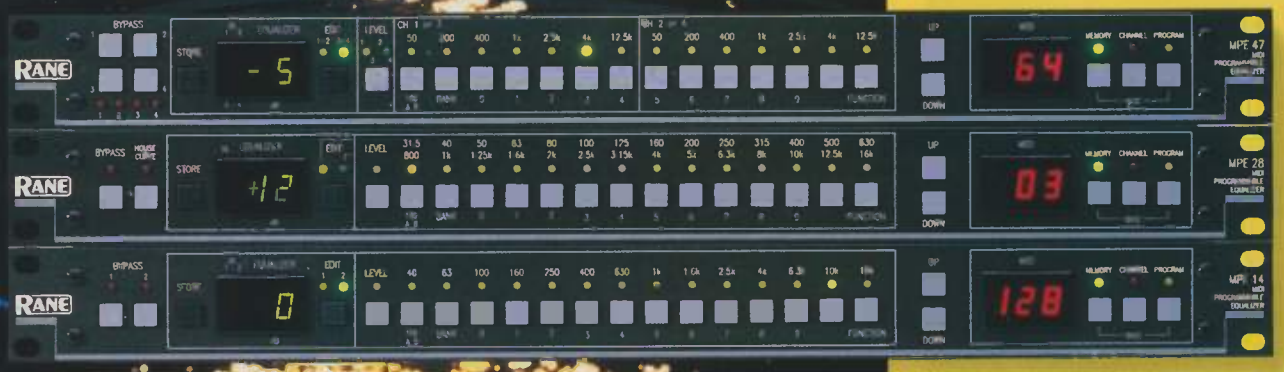

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house engineer's cooperation, your chances of making a decent recording are somewhere between slim and none.

Communication is all-important; check in with the house engineer at least two weeks before the gig to go over your plans. There should be *no* last-minute surprises. This meeting may take some time, so try to find a non-hectic time when the two of you can sort things out over lunch or a couple of drinks. Pick up the tab and add it into your recording budget. Bring a stage plot showing the locations of the band members, along with a listing of their instrumental setups, vocal mic requirements, and AC power needs.

Your discussions with the house sound engineer should include:

- The possibility of getting tape recorder feeds from the house console. Many P.A. boards also include direct outputs for each input channel, extra bus/submix channels, and matrix outputs. If the club has an onstage monitor-mixing board, there is an additional chance that the main house console may have prefader sends (which would not be used when the monitors are mixed from the stage) that could also function as track outputs. When interfacing with the house console, make sure you find out what types of connectors (XLR, RCA, or 1/4-inch) and levels (-10 dBV or +4 dBm) are used for the various channel sends/outputs.
- Deciding on a location where you can set up your recording gear. In most clubs, space is at a premium, so this is sometimes not quite as easy as it sounds. If you can't set up near the house console, you may be able to find some space offstage or backstage. In such a case, you still may be able to get channel feeds from the monitor mixing console. You might even consider setting up a mini control room somewhere backstage, with small reference speakers or headphones for monitoring.
- Select locations for placing audience mics and cable routing pathways that won't interfere with sightlines or cause tripping hazards. Ditto for AC power lines, if necessary.
- Determine load-in and soundcheck times for the day of the show. If your band is the only group playing that night (or if you're the opening act), it may be possible to set up and make some test recordings earlier that day. If this is the case, you may want to put a few bucks aside from your recording budget to pay for the house engineer's overtime. You also should keep in mind that the house engineer is a vital element in the success of any remote recording project, and should be treated accordingly.

EIGHT TRACKS AND BEYOND

Up to this point, we've looked at 2- and 4-track recording methods, but if you have access to an 8-, 12- or 16-track recorder, life can get a lot more complicated and a lot more fun. For one thing, when an instrument or vocal part is recorded on its own track, it may be possible to overdub parts at some later date to fix mistakes. Of course, any decisions about track assignments depend entirely on the number of instruments and vocalists in the group, but let's start by examining a typical band consisting of drums, bass, guitar, keys, and two singers. In the studio, the parts would probably be recorded as follows:

TRACK	CONTENT
1	Drum Submix, Left
2	Drum Submix, Right
3	Bass Guitar
4	Lead Guitar
5	Keyboard Submix, Left
6	Keyboard Submix, Right
7	Vocal #1
8	Vocal #2

The same tracking arrangement also could work for a live recording, but with only eight tracks to work with, there are no additional tracks available for capturing the enthusiasm of the crowd as they cheer wildly and scream for encores. (You did remember to invite your *friends* to the gig, didn't you?) To make room for one or two audience tracks, you could have recorded the keyboard and/or drum tracks in mono, but the overall quality of the recording would suffer. One alternative is to record the audience on a separate stereo machine and play back portions of the tape to supply audience reactions during the mix. (Due to the lack of mechanical synchronization, this method is known as "wild" sync. It is used extensively for sound effects in motion picture production.) You also could loop some ambience sections from this tape and fly these in during the mix, using a sampling keyboard. This is especially useful when you want to add the occasional hint of clinking

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glasses or other background sounds, just enough to remind the listener that this is a live (well, sort of live) recording. It's not perfect, but with a bit of effort, this method can work well.

Another alternative for 8-track recording (assuming that you're not recording a stand-up comic or an acoustic guitar/vocal duet, in which case you have plenty of available tracks) is to expand upon the 4-track scenario described earlier. The chart at right demonstrates how such a session tracks.

TRACK	CONTENT
1	Board Mix, Left
2	Board Mix, Right
3	Audience Mic, Left
4	Audience Mic, Right
5	Vocal #1
6	Vocal #2
7	Lead Instrument
8	*

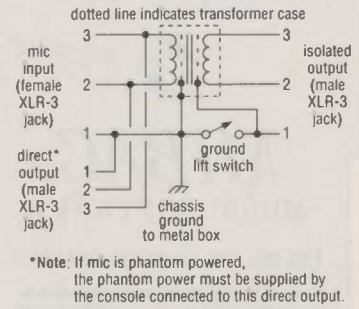
Building a Microphone Splitter

Microphone splitters take various forms, ranging from a simple 1 x 2 (one input, two outputs) to elaborate versions incorporated into multichannel stage snakes. Systems are available from numerous manufacturers, including ProCo (tel. [800] 253-7360), Rapco (tel. [314] 243-1433), Sescom (tel. [702] 565-3400), Brooke-Siren Systems (distributed by AKG; tel. [415] 351-3500), Whirlwind (tel. [716] 663-8820), Peavey (tel. [601] 483-5365), and others. If you're willing to invest a little cash and a couple hours time, though, you can put together a mic splitter or system that exactly meets your needs.

Transformer mic splitters are passive devices, so few parts are required and assembly is simple. The transformers themselves are not readily sold at most parts houses, but are available through specialty sources, such as Jensen Transformers (tel. [213] 876-0059), Reichenbach Engineering (tel. [818] 765-6040), and Sescom. These companies can supply schematics and applications notes for building mic splitters, as well as direct boxes.

The most difficult part about building a mic splitter is cutting the XLR mounting holes in the box, which must be metal to provide adequate shielding. A typical circuit for a 1 x 2 splitter is shown at right. Some designs require resistors on the isolated output, so check the manufacturer's recommendations that come with the transformer. Most audio splitter transformers include long, color-coded leads that can reach all the components in the case, so the actual wiring can be completed in under ten minutes. Plan the placement of the XLR jacks carefully before you start any metalwork.

One thing to keep in mind is that the circuit shown below is the most basic, simple design for a 1 x 2 splitter. You can create other variations by using multitap transformers for 1 x 3 and 1 x 4 splitting configurations or build several transformers into a large case to provide multichannel capability, such as four or eight channels of 1 x 3 splitting. If you really want to get ambitious, you could incorporate mic splitters into the stage boxes of your snake system, but the simple splitter shown here should give you an idea of how easy it is.—GP



Schematic for a 1 x 2 microphone splitter.

This arrangement gives you the flexibility to combine the board mix and audience mics, but with the addition of instrumental and vocal tracks to make up for any deficiencies in the house mix. Track 8 is intentionally left blank here so you can record bass, snare, kick drum, synth, or a third vocal, whatever you deem important. Remember that all the tracks except the audience mics will have to be time-delayed when you mix. The easiest way to do this is to sub-mix those tracks, route them through a stereo digital delay (or two mono units), and combine them with the audience mic tracks.

If you own (or have friends who own) a 16-track machine, you should have plenty of tracks available to handle most location recording sessions. Here's a sample track log for a typical session, with drums, bass, keys, lead and rhythm guitars, and three vocalists:

TRACK	CONTENT
1	Kick Drum
2	Snare
3	Drum Submix, Left
4	Drum Submix, Right
5	Bass Guitar
6	Rhythm Guitar
7	Keyboard Submix, Left
8	Keyboard Submix, Right
9	Lead Guitar
10	Vocal #1
11	Vocal #2
12	Vocal #3
13	Audience Mic, Left
14	Audience Mic, Right
15	Guard Track
16	SMPTE Time Code

In this instance, I've also added a track for SMPTE time code, which is not essential, but permits later lock-up to video and the synching of MIDI tracks for additional sweetening when you mix. Track 15, a "guard track," is nothing more than an unused track that is adjacent to the time code track to prevent the grating whine of the SMPTE signal from "bleeding" into an audio track. If you do not require the SMPTE signal, then tracks 15 and 16 could be used for other purposes, such as adding more keyboard tracks.

Since we now have plenty of tracks for the band, the two audience mics do not carry the load of recording the music. Therefore, the audience mics can be placed somewhere near the

stage, pointing *toward* the audience, and there is no need to use digital delays to make time compensations during the mix. In this case, the audience mics are part of the sweetening and can be brought up in the mix at appropriate moments (exuberant cheering at solos, song segues, etc.) and brought down to a comfortable level during the songs.

DOUBLE-MIKING

Most of the recording methods discussed so far involve getting track feeds from the club's sound system. However, there are a number of other methods that can be used, either in conjunction with, or in lieu of, patching into the house system. The most tried and true of these is double-miking, where the recordist uses a second set of microphones in addition to those mics utilized by the P.A. system.

Double-miking offers the advantage of simplicity. You bring your own mics, plug into *your* snake, which of course is routed into *your* console, and mix or track any way you want. Total double-miking does not involve interfacing with anyone else's system, so nagging questions concerning who is to blame for the myriad mysterious pops, buzzes, hiss, and other electronic hash in the system are eliminated.

On the minus side, double-miking means a massive amount of superfluous stage clutter, and you need to come up with a lot of extra gear, such as mics, stands, and booms. When shooting a video, it's really ugly if your lead singer has to hold two mics in one hand (with two cables dangling down). In some cases, a simple "Y" cable might remedy the situation, but there is a good chance of encountering distortion, ground hum, and lowered frequency response when two consoles are linked directly by a "Y" cable. Sometimes it works, but usually it doesn't.

Fortunately, mic splitting offers a workable solution. A mic splitter is a device that has one mic input and one or more outputs, each transformer-isolated from the other, allowing a single mic to feed several sources (house console, monitor console, recording console, etc.) simultaneously. While 1-input/2-output types are most common, mic splitters are available from any number of manufacturers as compact, stand-alone boxes, or wired into large snake/interconnect systems. Mic splitters often incorporate ground-lift

switches, offering the ability to disconnect the mic's ground connection between two consoles if a grounding hum problem occurs.

Most splitters use a design whereby one of the outputs (designated as the "direct" output) is connected in parallel to the mic input. There is a direct, hard-wired connection between the input and the direct output, so if phantom power is required for any microphone, then the phantom power must be supplied by the console connected to the direct input. If you want to build your own splitter, see the sidebar "Building a Microphone Splitter."

ADDITIONAL CONSIDERATIONS

Whether you're recording to 2- or 24-track analog reel-to-reel, tape speed is an important consideration. Just about everybody agrees that a recording made at a speed of 15 inches per second sounds better than 7.5 ips. However, a 10.5-inch reel contains 2,500 feet of tape, which translates to about 33 minutes of recording at 15 ips, or 66 minutes at 7.5 ips. I don't want to tell you what speed to use, but if you're recording at 15 ips, and your set runs over 33 minutes, then you should plan a few minutes of stage banter to cover the reel changeover time. Of course, if you're recording to DAT or analog cassette, just make sure that the tape lengths you use are sufficient to cover the set.

As mentioned earlier, detailed planning is an essential part of avoiding the (inevitably bad) surprises that seem to accompany recording ventures outside the cozy confines of the studio. Make a list of what you need, including both the usual and the unusual, and check it twice. How about blank tape, take-up reels, batteries, audio adapters, cables, duct tape, a flashlight, headphones, AC extension cords, spike/surge suppressors, AC power conditioners, or even a few small tables to support your equipment? Also, don't neglect to bring spares. It's a well-known fact that in the history of modern technology, *no* piece of equipment has ever been known to fail when a replacement was readily available. Another nice addition to your list would be a couple of dedicated helpers ("production assistants," *not* roadies) to take care of the little details—schlepping equipment, hunting for AC outlets, parking the truck, making the deli or pizza run, etc.—so you can focus on the big picture.

Successful location recording involves many choices and many options, whether you set up your recording gear near the main P.A. console, backstage in a dressing room, or snaked to a van parked outside the stage door. Your sound sources can come from house or monitor board feeds, audience mics, mic splits, or even some doubled mics on the instrument amps (where they are easy to set up and tend not to get in the way). There are a thousand ways to do a remote recording; all of them are right, and all of them are wrong. It's up to you to look at all the options, shuffle the deck, and deal a winning combination that works in your situation. Just be realistic and be prepared.

EM ***editor*** **George Petersen** ***began his musical career playing drums in cheap clubs in Italy nearly 25 years ago.***

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DECODING SMPTE

Afraid your time code might be marching to a different drummer? Here's the word on SMPTE and its various formats.

ERIK ADIGARD

SMPTE time code has become a valuable tool at all levels of music and post-production, thanks to falling costs in hardware and software. Today, thousands of musicians and engineers use the stuff to link audio and video tape decks, hard disk recorders, automated consoles, and sequencers. But it seems the more people use SMPTE time code, the more misconceptions get spread around. It's easy to get confused about the various "flavors" of time code, their frame rates, and this thing called "drop-frame." Maybe it's because some of it makes perfect sense, while some seems completely counter-intuitive. Let's see what we can do to clear the air a bit.

The SMPTE time code signal—often called simply "SMPTE"—consists of digital "words," each containing 80 bits. The meaning of each bit is laid down in the SMPTE specification published by the American National Standards Institute (ANSI). Each word contains a location number, a "sync word," several "user bits" (which the user can encode with auxiliary information such as reel numbers or dates), and a couple of "flags" indicating the type of code being used.

In video, there are two forms of SMPTE time code in use: longitudinal time code (LTC) and vertical interval time code (VITC). With LTC, the signal is modulated

By Paul D. Lehrman

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onto an audio tone, so it can be recorded on audio tape or the audio track of a videotape. In VITC, the time code is integrated into the video signal itself and recorded onto the video portion of the tape. VITC has two big advantages over LTC: It does not require that you give up an audio track, and it allows you to know the exact frame location, even when viewing single video frames. On the down side, VITC equipment is generally more expensive, though that is starting to change (see the review of Mark of the Unicorn's Video Time Piece on p. 94). Most music and sound applications use LTC so that sequencers can be referenced to audio tape. In either format, the actual information incorporated into the signal is identical.

The location number in the SMPTE word is expressed in hours, minutes, seconds, and frames. A frame is the same interval as a television frame—SMPTE's original use, after all, was for timing television programs—which is about 1/30th of a second. So, approximately 30 times every second, the device reading the SMPTE code is updated to the current location of the tape. The reader also can tell if the tape is running fast or slow by checking the speed of the incoming SMPTE signal.

SMPTE TIME VS. REAL TIME

If television ran at *exactly* 30 frames per second (fps), this article would end here, but it doesn't. And that's why we have different types of SMPTE, which is where most of the confusion comes from. Here's how this situation came about.

When the American TV industry shifted from black-and-white to color, back in the 1950s, a subtle change was made in the way the signal was transmitted. Black-and-white TV had been moving right along at a frame rate of exactly 30 fps. When color was introduced, however, it was discovered that different parts of the broadcast signal would beat against each other, causing considerable problems. To alleviate these difficulties, the frame rate was slowed down, ever so slightly, to about 29.97 fps. The slight change in frame rate didn't faze existing receivers—they could just lock onto it—so backwards compatibility with black-and-white receivers already in people's homes was maintained.

Today *all* broadcast and cable TV signals in North America are sent at 29.97 fps, following the NTSC format. (A television frame consists of two "fields" of alternating lines, so you may see this number expressed as 59.94, which is the "field rate.") When a station broadcasts a black-and-white picture, it doesn't revert to the 30 fps rate, it just leaves out the color signal. All video production, amateur and professional, is done at 29.97 as well. Although it might be possible to find a true 30-frame videotape in someone's ancient archives, it's probably safe to say that such a tape will never cross your heads.

When SMPTE time code is laid ("striped") on a videotape, it is locked to the frame rate of the video, so that the beginning of each SMPTE word coincides exactly with the beginning of the video frame it describes. But you can't count a fraction of a frame, so time code still assumes there are exactly 30 frames in every second. This means that at any given moment, the SMPTE time—i.e., the location number in the SMPTE word, sometimes called "color time"—and the actual elapsed time of the program—i.e., the time shown on the clock on the wall that started running the moment you hit the Play button—are going to disagree. The time code thinks there are 30 frames in a second, while the wall clock knows there are only 29.97.

At the end of an hour-long program, the accumulated error will be 108 frames, or 3.6 seconds. In other words, a program exactly an hour long that starts at SMPTE frame 01:00:00:01 will end not at SMPTE frame 02:00:00:00, but at 02:00:03:18. Conversely, a program that runs from SMPTE frame 01:00:00:01 to frame 02:00:00:00 will be only 59 minutes and 56.4 seconds in duration.

DROP THAT FRAME!

To compensate for this error and make the SMPTE time agree with the wall-

Time Code and Hard Disk Audio

With the new hard disk recording systems that work in conjunction with MIDI sequencers, such as Digidesign's *Sound Designer II 2.0* and Opcode's *Studio Vision*, a new set of problems is emerging. Unlike conventional sequencers, which faithfully follow whatever time code is fed to them and speed up or slow down gracefully without changing pitch, digital audio recordings are based on an absolute time reference. If that reference changes, not only will the music slow down or speed up, but the pitch will be altered.

If the change varies over time, wow and flutter will be heard in the audio track. If the timing shift is consistent, there won't be wow and flutter, but the digital audio will play back out of tune with the MIDI tracks. Therefore, it's imperative that the digital audio system know what timing reference—30, 29.97, or something else—is going to be used for final playback.

A more subtle but potentially even deadlier problem crops up when you are editing a piece and want to play a digital audio file starting at a point other than its beginning. Here's an example: Your time code is running at 29.97 and your digital audio sampling rate is 44.1 kHz. An audio file starts at SMPTE frame 01:00:00, and you want to hear it starting from SMPTE frame 01:01:00—one second after it begins.

If the program thinks that 30 frames equals exactly one second, the file will start playing at the 44,101st sample. If the time code is actually running at 29.97, however, this will be the wrong place; a SMPTE second is actually longer than a wall-clock second. What you really want is the audio to start playing at the 44,145th sample. Forty-four samples may not seem like much, but stretch this out to a three-minute song or an hour-long TV show, and you've got some major discrepancies. Therefore, hard-disk audio systems must know what the true SMPTE frame rate is at all times.

clock time, something called Compensated Mode time code, popularly known as "drop-frame," was invented. In drop-frame, at the beginning of each minute the first two frames—:00 and :01—don't exist; they're dropped. The frame that follows 01:02:59:29 is not 01:03:00:00, but 01:03:00:02. There is still some drift between wall-clock time and time code time, but it never exceeds two frames, because it gets compensated for every minute(see **Fig.1**).

If you drop two frames out of every minute, in an hour you'll lose 120 frames, which is too many. So frames are *not* dropped at even multiples of ten minutes, including the top of the hour: 01:09:59:29 is followed by 01:10:00:00(see **Fig. 2**). That gives exactly 108 frames, which is what we want.

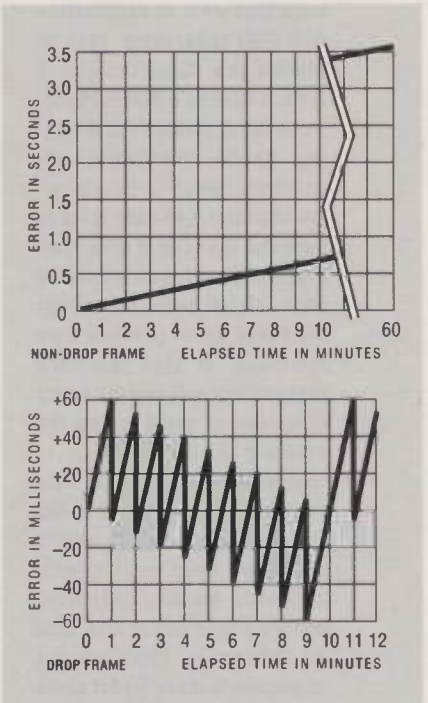
The older method of using time code, in which all frames are numbered consecutively with no breaks, is called Uncompensated Mode, non-drop frame, or simply non-drop. The important thing to remember is that the difference between the two is *not* that the tape travels at different speeds, or that there are different numbers of frames per second. The tape speed is the same, and the frame rate (for video) is *always* 29.97. But the same frame in the two formats will have *different names.* That's all. To make sure there's no confusion, the SMPTE word itself contains a flag—bit number 10—to tell the reader whether the code is drop or non-drop.

Since SMPTE is television based, you'd think that it always runs at 29.97, but that's not quite true. In non-video applications, where you're not locked to the NTSC frame rate, it is sometimes more convenient to use true 30 fps code, so that you don't have to deal with dropping frames, *and* the SMPTE time is equal to the wall-clock time.

For example, some audio mixing-automation systems that use SMPTE for reference generate their code at exactly 30 fps. As long as such a system is used by itself, this represents no problem, because all of its timing references will be self-consistent. However, if the audio tape is then synchronized to a video system of any kind, it would play back 0.1% slow. This may or may not be a problem (do you care if your music video plays at A=439.6 Hz instead of A=440?), but just in case, manufacturers of professional time code equipment like Adams Smith and Cipher Digital recommend that the 29.97 rate be used whether you're working with video or not—although their generators will happily write code at either 29.97 or 30.

An important point: The difference between 29.97 and 30 has to do *solely* with the speed of the signal, while the difference between drop and non-drop has to do with the way frames are counted. (It resembles the difference between tempo and meter in music.) While there is a flag in the SMPTE word denoting drop or non-drop, there is nothing in the time code signal to tell you whether you're running at 29.97 or 30 (or any other arbitrary rate, for that matter). There is something called a "Color Frame" flag, but telling you the frame rate is not its purpose. Non-drop code recorded at 30 and played back on another deck running 0.1% slow (within the tolerance specs of many audio decks) is indistinguishable from non-drop 29.97.

This leads to another great source of confusion about time code: terminology. "30 drop-frame" means, to most people, 29.97 drop-frame code. But "30 non-drop," depending on whom you



Graphics adapted from cipher digital *Time Code Handbook*

FIG. 1: The address numbers of non-drop-frame time code will have a significant deviation (3.6 seconds) from a real-time clock after one hour, whereas drop-frame time code maintains a closer relationship to wall-clock time and is exactly in sync at every ten minute point.

talk to, means either 29.97 non-drop or true 30 non-drop. An unambiguous term sometimes used for 29.97 non-drop is "Slow 30 non-drop."

Because of this and other misunderstandings about the SMPTE specification, there has arisen an unfortunate assumption, particularly among companies who are new at all this, that if the Bit-10 flag is set to non-drop, then the code must be running at exactly 30 frames per second. One example of this is Opcode's *Studio Vision:* If you put it into Tape Calibration mode and feed it 29.97 non-drop code, it reports that your code is running 0.1% slow. Another is Apple's *MIDI Manager* software, which has no provision in its menus for 29.97 non-drop.

Neither of these problems is particularly dangerous, as both programs will sync quite happily to 29.97 non-drop; they just don't realize that's what they're doing.

And yes, there is "30 drop-frame" that runs at exactly 30 fps. Although you will probably never encounter it, in certain circumstances during the final stages of a film production, where a finished music score is being "married" to the print, true 30 drop is necessary to make sure everything locks up.

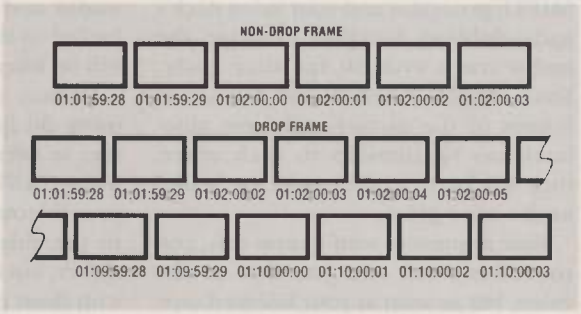


FIG. 2: The counting difference between non-drop-frame and drop-frame time code occurs at the minute points. Note that to maintain sync with a real-time clock (and compensate for overdropping frames), drop frame code does not drop frames at ten minute divisions.

WHAT SHOULD I USE?

As the more established manufacturers suggest, it's probably a good idea to stick to 29.97 as a frame rate, but if your equipment for some reason doesn't support it, you're not in as much trouble as you might think. For example, say you print 30-fps time code on a tape, lock your sequencer to it, record the music on another track on the same tape, and hand it to a film producer. He puts it on a tape deck locked to a video running at 29.97. As long as all of your cues have been aligned to correct frame numbers (as they appeared on the original video), then your music will play slightly slower, but it will still lock perfectly to the picture.

But big problems occur when there are inconsistencies in the way the time code is handled. A potentially disastrous situation that is unfortunately becoming increasingly common as more people get into SMPTE arises from this scenario:

A producer hands you a video workprint, and you use your inexpensive

SMPTE generator and your video deck's audio-dubbing function to stripe the audio track with 30 fps time code. Your SMPTE numbers and the actual frames of the picture will have absolutely no relationship to each other; they will begin to drift apart, or "walk," as the tape plays.

Your sequencer won't know this, and your music will sync just fine to the video, but as soon as your finished tape (striped with time code) leaves your studio and is played back on a deck locked to the video, none of the music will be where it's supposed to be.

In fact, you don't even need to be using 30 fps time code for this situation to occur. It will happen if you are using 29.97 code, and you've striped your videotape "wild," without reference to the video signal. The drift will be slower, but it will still be there (although with short pieces, say under a couple of minutes, it often won't be noticeable).

Time code on a videotape *must* be synced directly to the frames of the picture itself, in a process known as "genlocking." Anything else, and you're asking for trouble. Genlocking is something a professional video studio can do easily, and now you can even do it in your home studio, using relatively inexpensive new products from Fast Forward Video or Mark of the Unicorn.

TO DROP OR NOT

If your frame rates are okay, you can still have problems moving tapes between studios if there is no communication about whether they are printed with drop or non-drop time code. An editor who doesn't know that his video edit list is in one format and the edit list for his audio reel is in the other will have the devil's own time figuring out why the tire squeals seem to happen *after* the car has gone over the cliff.

Generally, the choice of whether to use drop-frame or non-drop will be made for you: Whatever format the original source you're working from uses is what you should use. If you do have to make your own choice, there are advantages and disadvantages to each.

Working with drop-frame code is not the most intuitive of processes. If you want a sound effect to start at 03:59:29 and end three frames later, you have to set its stop time to 04:00:04, not 04:00:02. If you are using a tempo-stretching function in a sequencer to make a musical cue fit a specific period of time, and the cue happens to cross a minute boundary, you have to remember that the real time for the cue is two frames *shorter* than the difference in frame numbers would indicate.

Non-drop has its drawbacks, too. If you're following a non-drop-based

The Joke's On Us

British engineers have been heard to offer the following meanings for the acronyms used in various television systems:

NTSC (U.S., Canada, Japan)—"Never Twice the Same Color";

SECAM (France)—"System Essentially Contrary to the American Method";

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program with a stopwatch, the duration of a cue computed by the edit list and the elapsed time shown on the stopwatch are not going to be the same, and the longer the cue, the greater the difference.

MORE FLAVORS AND A FINAL MONKEY WRENCH

Two more types of SMPTE time code are provided for in the SMPTE specification, and they show up on the front panels or in the control software of many SMPTE devices. Chances are slim you'll need them.

Our friends in Europe watch television that runs at 25 fps, so they use a version of the code known as EBU time code (for European Broadcast Union), which counts 25 frames in each second instead of 30. Since European television runs at *exactly* 25 fps, they don't need to deal with all this drop/non-drop nonsense, and in fact, they do their share of laughing at us over it (see sidebar, "The Joke's On Us"). You only need to worry about this if you find yourself doing a European film, in which case you'll need to stripe your finished masters with 25 fps code so your post-production people over there can play them. (You'll also need a PAL/SECAM video deck to play the things on, or ask your producer to provide you with an NTSC workprint.)

There is also a 24 fps version of SMPTE time code described in the spec, which corresponds to the frame rate of film. This was supposed to allow direct reading of film frame numbers into edit-list systems, but when that sort of thing is needed (either for off-line editing or music scoring), the film is normally transferred to videotape, and video frame rates can be used. Although 24-frame SMPTE is certainly possible, I have yet to encounter anyone who has ever used it, or has even ever *heard* of it being used.

Just to make you more confused: I said earlier that color TV ran at "about 29.97 fps"—the true figure is 29.97002617 fps. At the end of a 24-hour-long program, the actual elapsed time and the drop-frame time will be off by 75.4 milliseconds (a little over two frames). For this reason, broadcast stations and large video houses running around the clock need to reset their master time code generators every few days, but you probably don't need to worry about it.

For an excellent reference on SMPTE in general, I recommend the *Time Code Handbook*, published by Cipher Digital, Inc., PO Box 170, Frederick, MD 21701; tel. (800) 331-9066. It's very thorough, yet not difficult to understand. A new edition should be out by the time you read this. For a good book about synchronization issues in general, check out *Synchronization From Reel to Reel*, by Jeff Rona and published by Hal Leonard.

(Thanks to Evan Brooks of Digidesign, Jeff Junker of Adams Smith, Steve Scott of Skotel, a SMPTE board member, and Bob Tulloh of Cipher Digital for their help.)

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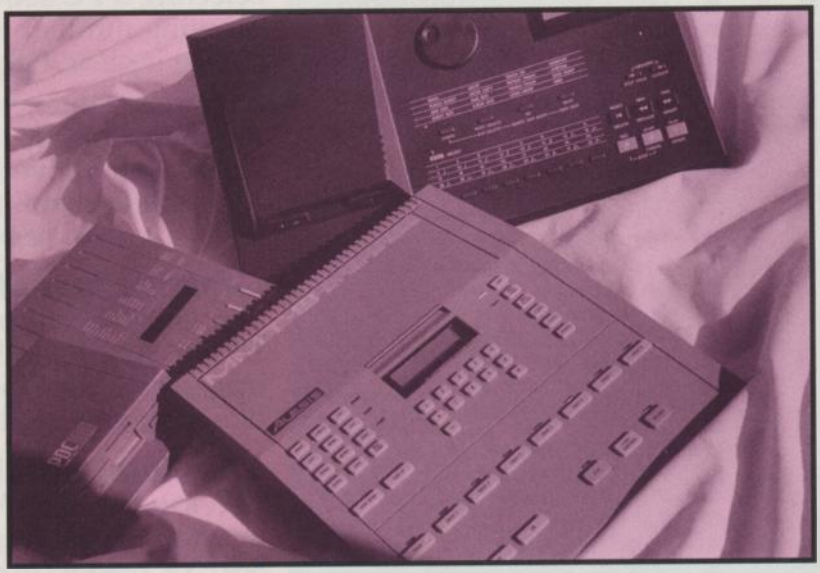
GUIDE TO HARDWARE SEQUENCERS

REPORTS OF DEDICATED HARDWARE SEQUENCERS' DEMISE APPEAR PREMATURE, AS TODAY'S FEATURE-PACKED MACHINES FIND PLENTY OF APPLICATIONS.



JULIAN OKWU

So many musicians use either a personal computer or a sequencer integrated into a keyboard instrument that it's easy to dismiss a dedicated sequencing unit as a luxury item, or as virtually obsolete. These opinions are particularly common among those who use a computer or keyboard sequencer in a studio environment. Lots of people still purchase standalone hardware sequencers, though, and for excellent reasons.

For one thing, many computers are built for use in the relatively benign environment of the home or office and may not live up to the conditions found at the typical gig. Unless you use a well-built laptop, or have outfitted your computer with a sturdy road case and a heavy-duty power-conditioning system, and you handle it with lots of TLC, you might find it unreliable in concert situations. Besides, it's no fun to lug around a desktop computer.

Sequencers integrated into most "workstations" are usually built well but suffer from such weaknesses as limited sequence memory, minimal editing

BY CHARLES R. FISCHER

features, and memory storage methods that can be ridiculously expensive (RAM cards).

If you already use a synth with an onboard sequencer or a software (computer-based) sequencer, you may prefer having more than one sequencer available at a time. Many computer-based musicians own several sequencer programs and transfer files between them to take advantage of special features. A similar situation can exist between a hardware sequencer and a software sequencer.

Also, you can slave a stand-alone box to your existing sequencer, adding tracks, MIDI channels, nested sequences, and other functions. Finally, you can use the dedicated hardware unit as a "scratch pad" to record things such as improvisations and rough compositions that can be polished in your other sequencer.

If you're still not convinced that hardware sequencers have their uses, maybe you'll reconsider when you see what your money will buy these days. Most units on the marketplace offer many of the editing options available in computer sequencers, located in one handy little box. When you can do the job for a relatively low price, it's hard to justify hauling around a computer.

The easiest way to evaluate the current crop of hardware sequencers is to glance at the comparative chart on p. 76. The chart lists the most important features and specifications for each model, letting the specs speak for themselves.

CHART CATEGORIES

From here on, we'll discuss the crucial features to consider when sequencer-shopping. Keep in mind that, as with most music equipment, the most important variable is you. Your selection should account for how you prefer to work, what types of projects interest you, and what other gear you use with a sequencer. We'll start with the bottom line, then get into features.

List Price: Cost in U.S. dollars inevitably serves as the bottom line for many of us.

Sequencer Memory: The amount of internal RAM, expressed in kilobytes (KB) available in each model. Some machines, such as the Yamaha QX5FD, use dynamic (volatile) RAM, so if the power goes, so does everything you've recorded since the last time you saved. Such units are marked "DRAM" on the

Anatek Pocket Sequencer

chart. Units such as those from Kawai and Alesis have static (non-volatile) RAM, which retains your data after the power is turned off (assuming the internal battery is okay). Static RAM appears as "SRAM" on the chart.

Sequencer Memory (MIDI Note-on/Note-off events): Differences in design mean that two sequencers could have the same amount of memory, yet one may hold more MIDI events than the other, thanks to a more efficient design. Therefore, we're also specifying the approximate number of MIDI Note-on and Note-off events that can be held in the sequencer memory, which is a more musically appropriate yardstick for available memory space.

Most musicians make use of other MIDI data (including controllers such as Pitch Bend, Modulation Wheel, Footpedal, and Aftertouch), however, which use up more memory. Unless you're satisfied with a sequenced performance that doesn't use any of these common MIDI messages, the actual number of Note-on and Note-off events will be somewhat lower than the ideal figure. This isn't due to malfeasance from the manufacturer; there is limited available RAM in a sequencer, and each user must decide how it is best used.

Tracks: The total number of independent tracks available for the recording or playback of performance data. It might seem that more tracks are better, but again, appearances can be deceiving. For example, some designs allow you to record up to sixteen MIDI channels on a single track, while more limited versions only allow a single MIDI channel of data per track. This is the case in most early sequencers, so if you use one of these antiques, you need at least sixteen tracks to take advantage of all sixteen MIDI channels. Most newer designs are far less restrictive, accommodating sixteen channels on one track. This is indicated by "Multich" on the chart. In general, it's preferable to be able to record sixteen channels onto a track; you still can record a single channel of data at a time, if desired.

Tracks Recorded Simultaneously: While related to the previous category, there are important differences. This tells you the number of tracks that can be set to record incoming MIDI data on a given pass. It's especially critical if the unit only records one channel of MIDI data per track.

A sequencer that allows only one channel of data per track *and* limits you to recording on one track at a time can be a major handicap. Take the example of a songwriter who is using a hardware sequencer for live performances. If the dedicated sequencer can record all MIDI channels on one track, or can simultaneously record the data on each channel onto separate tracks, the songwriter need only make one recording of the performance data per song. On the other hand, a sequencer that has both disadvantages makes things much more involved. The unlucky user must record each of the sixteen channels of performance data on a separate track and must go through the process sixteen separate times (as opposed to doing it once with a more sophisticated unit). Even if you don't expect to use this capability, the alternative is painful enough to avoid wherever possible.

Timing Resolution: Specifies how closely a particular sequencer accurately records timing of events in performance, measured in pulses per quarter note (ppqn). A higher number indicates that a unit is capable of finer resolution.

Timing resolution is especially important if you're technically proficient enough to play most (or all) of your parts into the sequencer without the need for quantization or other editing

Alesis MMT-8

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HARDWARE SEQUENCERS

MANUFACTURER AND MODEL	ALESIS MMT-8	ANATEK POCKET SEQUENCER	BROTHER MIDI-30/40	BROTHER PDC-100	KAWAI Q-80	ROLAND MC-50 MICROCOMPOSER	YAMAHA QX5FD
LIST PRICE	$299	$199.99	$259/$299	$399	$795	$895	$1,095
INTERNAL MEMORY	64 KB	none; uses 32 KB RAM card	32 KB/64 KB	128 KB	128 KB	256 KB	128 KB
INTERNAL MEMORY (MIDI NOTE EVENTS)	approx. 25,000	approx. 7,000	approx. 14,000	21,000	26,000	40,000	20,000
TRACKS	8	16	2 (1 record, 1 merge)	32	32	9 (1 for rhythm patterns)	16
TRACKS RECORDED SIMULTANEOUSLY	1 (multich)	1 or all 16	1 (multich)	1	16	8	1 (multich)
TIMING RESOLUTION	96 ppqn	96 ppqn	96 ppqn	96 ppqn	96 ppqn	96 ppqn (for MIDI events)	96 ppqn
SYNC	MIDI clock, tape	sends/receives MIDI clock & SPP	MIDI clock	MIDI clock	MIDI clock, tape	MIDI clock, tape	MIDI clock, tape (incl. SPP)
MAXIMUM # OF SEQUENCES	100	1	none	64 "units"	100/song	none	40
MAXIMUM # OF SONGS	100	none	1	1	10	8	8
DATA FILTERS	a, cc, notes, pb, pc, sx	none	a (poly/ch.), pb	a (poly/ch.), cc, notes, pc, pb, sx**	a, cc, ce ***, pb, sx, v	a, cc, pb, pc, sx, notes, v	a, m, pb, pc
MIDI PORTS	In/Out*	In/Out*	In/Out*	In/Out*	In/Out*	In/ 2 indep. Outs*	In/Out*
DATA STORAGE	tape	32 KB RAM card	3.5-inch floppy disk	3.5-inch floppy disk	3.5-inch floppy disk	3.5-inch floppy disk	3.5-inch floppy disk
EDITING FACILITIES	step mode, q, t	overdub and punch-in modes; quantize	punch-in/out	punch-in, step, and event modes	all	all	all
OTHER INPUTS/ OUTPUTS	tape in/out, click out	none	none	none	tape in/out, click out	tape in/out, click out	tape in/out, click out
FOOTSWITCH INPUTS	start/stop	1 (multifunction)	none	none	1 (multifunction)	start/stop, punch-in/out	start/stop
DISPLAY TYPE	16 x 2 backlit LCD	none	6-character LCD	16 x 2 backlit LCD	16 x 2 backlit LCD	20 x 2 backlit LCD	16x2 backlit LCD
OTHER FEATURES	autolocate	fast-forward and rewind modes; all features selected from 3-way control bar	Chain Play (loads & plays song files from disk, in sequence); records sysex	Chain Play, MIDI monitor mode	real-time, step, and punch-in (w/pre-roll) modes; MIDI monitor mode; tempo track; "humanize" quantization	software updates can be uploaded from disk	stores sysex

LEGEND

(a) aftertouch (cc) continuous controllers (i) included (m) modulation (pb) pitch bend (q) quantize (sx) system exclusive (v) velocity (pc) program change (t) transpose * MIDI Out with software Thru ** Both incoming and outgoing MIDI messages can be filtered independently. *** Control Each (CE): Filter can be used to defeat filtering on a specified controller, (all other controller data is removed).

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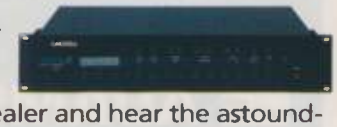

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tricks. It also is important if you're interested in shifting the time of certain events against others to enhance the feel of a rhythmic groove. (See "The Feel Factor: Music with Soul" in the October 1987 EM for more on this subject.) Accomplished musicians often are more critical of the slight timing inaccuracies found in lower resolutions than hobbyists or beginners, but many musicians can't hear any difference once the timing resolution hits a certain point. If you quantize parts, more often than not you won't hear any difference between 96 and 144 ppqn. I believe a resolution of 96 ppqn is the lowest acceptable resolution, unless you can live with quantizing everything 100% of the time. Once you get used to a higher resolution, you'll never be satisfied with a lower resolution.

Sync: This indicates if a particular model is capable of sending and receiving MIDI clock data. All of the units reviewed here both send and recognize MIDI clock; better designs allow you to keep the sequencer from transmitting clock messages when it's not necessary, which helps to keep the MIDI line free for better things.

Having the capability to synchronize to tape might be useful for home recordings; on the other hand, many inexpensive tape interfaces require care to give reliable results. While adequate for hobbyists and getting started, it's better to use SMPTE/MTC or an external sync box that provides MIDI clock and song pointer messages instead.

Maximum Available Sequences/ Songs: This tells you the maximum number of sequences and songs that can reside in memory at any given time. By "sequences" I mean a recorded chunk of MIDI data of no particular length (anything from one bar of 1/8 time on up).

A "song" is a finished composition that is assembled by taking individual sequences and placing them in a desired order. This approach allows you to record the various parts of a song on separate sequences and chain the individual sequences together to obtain a finished composition. For example, you might record the intro on Sequence 1, put the verse on Sequence 2, make Sequence 3 the chorus, and record the ending on Sequence 4. Then, combine the sequences to build up the finished song.

This concept allows you to record a song in smaller segments, as opposed to going from start to finish in a take. It

Yamaha QX5FD

also encourages you to experiment with the song form without screwing up a special take, as the individual sequences are untouched, and only the order changes. This makes it possible to try out different possibilities with a minimum of fuss. Adding or subtracting sections from a finished song makes it longer or shorter without having to worry about tape edits or tempo changes, which is great for anyone performing dance music.

Not all sequencers use the sequence/song method. For example, the Brother MDI-30/40 and the Anatek Pocket Sequencer do not allow you to assemble a song out of shorter pieces. With these, a "song" is a single sequence running from the beginning to the end of a performance. While this works for some musicians, others find it an undesirable limitation.

Once again, the maximum number of sequences and songs depends on how fast you use up that precious memory. It's possible to use up all of your memory on a single, mondo sequence; without any remaining memory, there will be nothing left for other sequences and songs.

Data Filters: As mentioned earlier, some types of MIDI messages use up more sequencer memory than others. Two of the worst offenders are pitch bends and polyphonic aftertouch (although any of the continuous controllers are nearly as bad). However, any type of message

ANOTHER OPTION: SEQUENCER PLAYBACK DEVICES

Suppose you primarily work on a computer-based sequencing program but need something that simply allows you to play sequences in a live performance without having to carry around a computer. There are other options available. The Alesis DataDisk SQ ($449) and MIDIMan's MIDIMan ($199) MIDI-to-audio converter do only two things: record MIDI sequences and play them back. If you only have a single, relatively simple sequence, Anatek's Pocket Record ($149) provides a similar function.

In the case of the DataDisk SQ, information is recorded onto a floppy disk. The MIDIMan device (reviewed in the December 1989 EM) converts MIDI information into an audio signal that can be recorded onto regular audio tape. In a best case scenario, MIDIMan can only record sequences that take up to 50% of MIDI's bandwidth without causing timing problems, so you must be careful about using sequences that don't have too many controller messages or events happening at once. For simple sequences, however, you shouldn't have any problems. The DataDisk SQ does not need to compress data like the MIDIMan and should be able to handle more complex sequences. Both devices have limited editing facilities and options and therefore don't appear in our chart, but they may provide all the functionality you need.

Also, at the recent NAMM Show in Anaheim (see this month's "What's New" for more details), Roland introduced the Sound Brush ($695), a half-rack device that reads standard MIDI files on 720K DOS format floppy disks—and therefore Atari ST, Amiga, and specially formatted Mac disks—and plays them back via its built-In MIDI ports. The unit also has the ability to record incoming MIDI data and convert it into Type 0 MIDI files. As a finishing touch, it even comes with a remote control. Keep an eye out for this one.—*Bob O'Donnell*

can be a problem if it competes for memory that is needed elsewhere.

Input data filters force the sequencer to ignore certain types of incoming messages while allowing everything else to pass unhindered. This reduces the amount of messages that are recorded and frees up memory for other purposes. Because any filtered data is ignored by the sequencer, the amount of messages coming out of the sequencer on playback is reduced, too. The amount of memory saved by filtering depends on the type of messages removed and the ratio of undesirable data to the total number of messages in the MIDI stream.

The continuous controller filtering option removes *all* continuous controller messages. These include Aftertouch (channel and polyphonic), Pitch Bend, Modulation, Footpedal, Breath Controller, and others. This indicates that the unit is unable to remove selected controllers while passing others. (For example, a more flexible filter might allow the removal of one or more specific controllers.) If a product allows the user to filter specific controllers, the types of controllers that can be filtered are listed. Products labeled "all" can filter any of the commonly used controller messages.

MIDI Ports: This indicates the type and number of MIDI connections. While some models do not have a hardware Thru port, the Out port often can be set to echo messages at the input port, providing what is called a "software Thru." This feature is indicated by an asterisk (*).

Data Storage: This category often is one of the most important differences to consider. Three common methods for data storage are floppy disks, RAM cards, and tape. Until recent years, the cost of a disk drive assembly was expensive, limiting it to high-end models. The least-expensive model with an onboard disk drive is the Brother MDI-30 (list price $259). RAM cards use semiconductor memory chips to store data for long periods of time in a relatively small and rugged package. Their primary disadvantages include high price and a significantly lower data capacity than a floppy disk. Tape interfaces allow data to be stored on cassette tape, making it the least expensive method of data storage. Tape has serious disadvantages when compared with disks or memory cards: It's slow and sensitive to variations in tape speed,

Brother MDI-30

tape type, and signal dropout. Because of these handicaps, you should limit its use to emergencies or situations where long waiting times are unimportant.

EDITING FACILITIES

This broad category covers any feature used to modify the original performance data after it has been recorded, including a wide range of tricks that range from the commonplace to the truly bizarre. While a detailed description of the many variations is beyond the scope of this article, we can look at some common features found in most sequencers.

Transposition shifts MIDI notes up or down by a user-specified interval. This can be used to move a song into a new key, bump melodies down to bass lines, or allow you to reach notes out of your controller's range.

Quantization is used to clean up timing irregularities in a recorded part, or to create parts that have a robotic perfection. While this feature is nearly universal, there are some differences in implementation. Good sequencers provide at least six different degrees of quantization; the more choices, the better.

Step Editing allows the user to enter or change notes or other performance data, step by step, without having to perform the changes in real time. While some musicians regard step entry as a cheap substitute for technical proficiency, it can be a useful tool for cleaning up slight flaws in an otherwise-perfect performance.

Punch-in allows you to cut into a sequenced track and record over earlier data at a specific point in the performance, as with a tape recorder. This is done in various ways depending on the model. Some allow you to set automatic punch-in/out points, while others make use of a footswitch to start and stop recording.

Controller Editing lets you change MIDI controller data without affecting other performance data. Since there is no standard way for handling this task, you'll find variations.

Copying, Merging: Copying one track to another lets you create parallel parts that can be independently edited and played on different MIDI channels. This is great for harmony parts, doubling, MIDI delay, and experiments. Merging combines two tracks into one, leaving a free track.

Channel Reassign: This often is called "MIDI channelizing" or "channel bumping." All sequencers in the chart, except those from Brother and Alesis, let you change the MIDI channel of any track.

CAPSULE COMMENTS

What follows is a short, subjective commentary on working with each of the units.

Alesis MMT-8

The MMT-8, which has been on the

market longer than the other models in this guide (it was reviewed in the August 1988 EM), is less sophisticated than most. Nonetheless, it achieved wide popularity due to its easy operation, flexibility, and many features that were only available at a much higher price. The MMT-8 is definitely not a state-of-the-art, full-featured sequencer; instead, it was designed to handle the needs of the mainstream semi-pro or professional composer/musician, which it does very well. Combined with the Alesis DataDisk, it can, in many instances, handle the needs of the economy-minded, or part-time, musician.

Anatek Pocket Sequencer

It's amazing that Anatek could fit all of these features into such a tiny box. It's also the least expensive unit in our survey, yet it has enough features to make it musically useful, particularly as a scratch-pad sequencer. Like most Anatek products, the unit measures a mere 3¼ × 2⅛ × 1¼ inches and needs no external power supply or batteries. Instead of an LCD and dedicated buttons, the Pocket Sequencer (PS) uses two LEDs and a 3-position momentary switch to control its operation.

The PS allows the user to select quantization level, tempo, and time signature as desired. Sequence data is stored on a RAM card, and a few nice touches—including selectable looping, "transport" controls (to "rewind" and "fast forward" through previously recorded data), and a footswitch input that can be used for several functions (start, stop, record, and accessing the loop and tempo/time signature settings)—simplify its operation.

I have mixed feelings about the Pocket Sequencer. While I'm impressed that Anatek crammed so much into such a tiny package, it's definitely not for everyone. Since a RAM card can holds a single sequence at a time, a user would have to buy plenty of cards in order to hold enough tunes for a set. Some may find it discouraging to use a single, 3-way button to access all features. Finally, the single page of instructions is terribly inadequate. (It neglects to mention that it can record on all MIDI channels at once, which is not a trivial omission.) Still, its attributes and low price make it a good entry-level (or second) sequencer.

Brother MDI-30/MDI-40

I found that both the MDI-30 and MDI-40 have limitations that made it difficult for use as a primary or second sequencer. First, the devices lack most of the common editing facilities that users have come to expect. Second, the MDI-40 seems to have been designed for the non-professional. These "baby" Brothers are best used as sequence-playback devices. The MDI-30 was reviewed in the February 1990 EM; the MDI-40 differs only in having 64 KB of RAM compared to the MDI-30's 32 KB, so the chart lists them together.

With the release of the considerably more powerful PDC-100, word went out that both earlier units were to be sold primarily as MIDI disk filers with limited sequencing capabilities. When re-evaluated in this light, the two seem much more usable to the semi-pro and

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pro crowds (and you still might be able to use it as a sequencer when your main unit is tied up elsewhere).

Brother PDC-100

I like the PDC-100 far better than the MDI-30/40. Brother put together a winning package this time around. It includes plenty of editing facilities, a fairly large amount of onboard memory, and an internal 3.5-inch disk drive, all for under $400.

The worst thing about the PDC is that its low price is partially due to a few compromises in user-friendliness—operations are performed via six multifunction buttons and a small LCD display—a limitation found in many types of inexpensive, high-tech designs. Maybe I'm just spoiled; I had several friends try it out and they loved it after a little practice. This one reservation aside, the PDC-100 offers plenty of raw power for a low price. Anyone seriously interested in a hardware sequencer should investigate it.

Kawai Q-80

The Q-80 has earned quite a few fans since its introduction nearly two years ago. It offered features rivaling competitors' models that sold for far more money. The ensuing success of the Q-80 forced other manufacturers to provide similar features for less money. Newer products like the Brother PDC-100 win out if you're comparing features versus price, but the Q-80 is a good machine.

I like the way the Q-80's controls are arranged on the front panel; the layout makes it easy to learn and use. The editing features are powerful enough to satisfy the needs of many professional users. Kawai obviously put a good deal of effort into its design, making it an intelligent compromise between features, ease-of-use, and price. It ended up as my personal favorite of the models in this article.

Roland MC-50 Micro Composer

The MC-50 is the newest entry from a company that produced sequencers long before the advent of MIDI. The MC-50 is based on the widely used MC-500 Mark II, and it's the most powerful dedicated sequencer available. It has several unique capabilities. First, the MC-50 has two independent MIDI outs that provide up to 32 channels of performance data. Another special touch is that you can load alternative operating system software from the disk drive,

allowing you to use the MC-50 for patch-storage and other tasks. In theory, this should make the unit as flexible as a computer-based system. (It remains to be seen if Roland will develop the software to take full advantage of this feature.) In terms of flexibility and power, the list price of $895 is reasonable.

Unfortunately, the MC-50's front panel layout is cluttered and less than user-friendly. There are simply too many controls squeezed in for comfort. While you can adapt to the layout with time, I'd prefer a more ergonomic approach. Another annoying factor, while the MC-50 has the power to rival many software sequencers, you're forced to use a relatively tiny LCD for a visual display. Roland has connectors for an optional video monitor on several of their samplers. Why not do this for the MC-50?

Nonetheless, the MC-50 is capable of delivering serious results. If you want maximum performance but are leery of using a computer onstage, it's an obvious solution. I just wish that Roland had put more effort into making it as user-friendly as it is powerful.

Yamaha QX5FD

The QX5FD is roughly equivalent to the Q-80 and PDC-100 in terms of capabilities, though it's been around somewhat longer. While it has an adequate amount of memory and editing facilities, the list price is high compared to other models in our chart. It's still worthwhile if you find a good deal; otherwise, it's hard to justify the price.

A FINAL THOUGHT TO CONSIDER

There's something that can't be measured or put on a chart: how a sequencer (or any musical instrument) responds to your musical instincts. Such seemingly subtle touches as the layout of the front panel or the number of keystrokes needed to perform a common operation can make a noticeable difference in your work. For some folks, easy and intuitive operation is paramount, while others would trade a little user-friendliness for additional features. You'll have to figure out what is more important to your needs.

Charles R. Fischer *works as a studio musician and synth programmer, designs and builds custom electronic equipment, serves as the MIDI editor for* Keyboards Today *magazine, and is senior electronics technician at Ondyne, Inc.*

How Sequencers Work

BY DAN PHILLIPS

Sequencers are more than simple data-recording devices; they have transformed the process of composing with electronic instruments.

Traditionally, a blank sheet of manuscript paper and a pencil have been a composer's most familiar tools. Electronic music technology has changed all that, however, and dramatically so. Today, composers have an electronic version of manuscript known as a *sequencer*, a device or program that records and plays back any musical idea, and has the unprecedented ability to change any aspect of a composition freely. A sequencer is one of the most powerful tools available to musicians and forms the heart of many an electronic music studio.

Sequencers often have been called electronic music's answer to multitrack tape. The comparison is accurate up to a point; sequencers can record musical data on individual "tracks," allowing musicians to assemble complex compositions from multiple performances. Sequencers also usually function in a manner similar to tape machines. But the similarities end there.

When you play into a sequencer, it records the physical actions of your performance, rather than the sound of the instrument. This information is like the rolls of a player piano: It tells which notes were played when, how hard they were hit, how long they were held, any movements of the sustain pedal (or other controls), and so on. All modern sequencers will record in real time, but many also allow recording by entering notes one at a time (step entry), specifying the rhythm and dynamics for each note individually.

When the sequencer plays back, it's as if the instrument were played by a live musician, except that the *sound* of the instrument becomes a thing independent of the notes being played. If you detune a player piano, or stick paper under the hammers, the pitch and timbre of the music changes accordingly. By the same token, sequencer data is independent from the sounds of the original performance. This independence lets you reorchestrate your music freely. A cello part can be played back as an electric bass, or a trombone, or a Minimoog synthesizer.

The magic of the sequencer is its power to alter a performance, changing or correcting rhythm, pitch, dynamics, timbre, and tempo. The musical composition becomes a living, changing entity. The sequencer is to the tape recorder what the word processor is to the typewriter.

There are many types of sequencers on the market today. Some are hardware boxes dedicated to sequencing; these are usually easy to use and quite reliable, but they may have limited features (see "Hardware Sequencer Buyer's Guide" on p. 72). Many synths and samplers now include a built-in sequencer. This can be both convenient and less expensive than an equivalent collection of separate components.

Other sequencers are programs that run on one of the popular personal computers. These tend to be less expensive than dedicated devices (if you already own a computer), and they usually tend to have more extensive features, with a more user-friendly working environment.

Certain basic features are common for any sequencer, regardless of type. Let's examine these and see what they can do for you.

TRACKS

An important point on a sequencer's spec sheet is the number of tracks. Hardware sequencers usually support a relatively small number, perhaps eight or twelve. Computer-based sequencers may allow you to use hundreds.

Such a plethora of tracks may seem excessive (especially since MIDI only has sixteen channels), however, several tracks can be used to control different aspects of a single instrument. Take drums, for instance. Instead of recording the whole kit on one track, you can record each sound on its own track, allowing you to edit them individually. When assembling a performance, it may be convenient to keep each performance controller—pitch bend, modulation wheel, etc.—on its own track.

On the other hand, fewer tracks may

not always be restrictive. While it is common to record a single instrument on a track, many sequencers let you record multiple MIDI channels on the same track. This allows you to "merge" tracks to make room for new ones, without any loss in sound quality. On most sequencers, it's possible to separate out a single channel for editing.

PHRASE EDITING

Editing is where the sequencer really shines. Rhythmic correction, known as quantization, is a common type of editing. Quantization lets you bring rhythmic precision to a less-than-perfect performance. This is great for tight dance-oriented rhythms or steady, percolating arpeggios (see **Figs. 1a** and **1b**). However, extreme precision is not always desirable. Rhythmic inflections—notes slightly ahead of or behind the beat—may be important to the character of a performance, and over-quantization can rob music of its feel. Many sequencers temper quantization with various "humanizing" options.

With one quantization option, known as "swing" (see **Fig. 1c**), the second rhythmic subdivision plays a little behind the beat, so that it approaches a triplet. Used judiciously, swing can create a

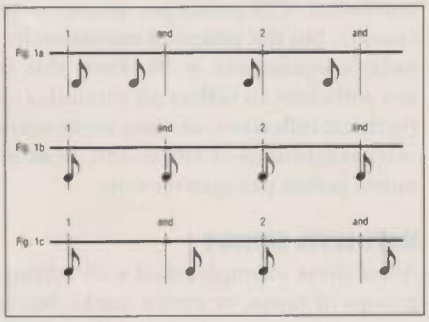


FIG. 1: (a) Four eighth notes as played into a sequencer, some ahead of and some behind the beat; (b) the same four notes after quantization, now perfectly in time but perhaps a little robotic; (c) the rhythm after swing quantization—every second eighth note is now slightly delayed, giving the phrase a more "human" feel.

more satisfying, less robotic groove. Some sequencers allow partial quantization, so that rhythms can be tightened without totally erasing the nuances of the performance; others allow you to insert controlled randomness or design complex groove templates, to loosen the rhythm or create a specific feel. Composers don't always agree on specifics, but it's generally accepted that

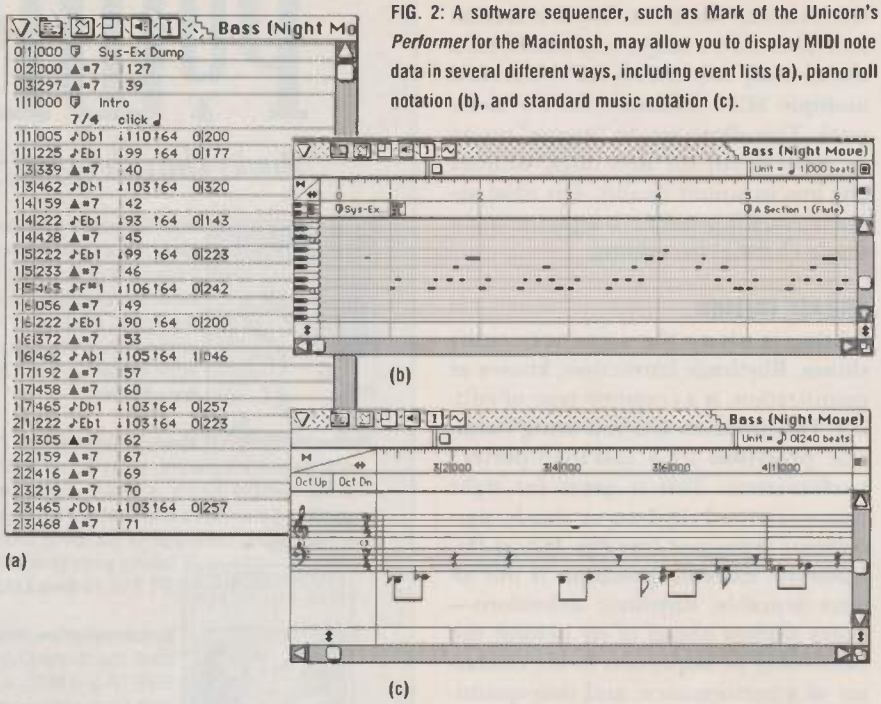


FIG. 2: A software sequencer, such as Mark of the Unicorn's *Performer* for the Macintosh, may allow you to display MIDI note data in several different ways, including event lists (a), piano roll notation (b), and standard music notation (c).

strict quantization is musically hazardous. The more options provided, the more likely you will find one that suits your needs.

Quantization is just one type of sequence editing. Transposition is extremely easy with most sequencers, and some sequencers allow you to change the mode (from major to minor, for instance) as well.

Switching a track from one sound to another is one of the simple joys of sequencing. But a different sound may require alteration of the performance as well. For instance, let's say the original sound had a long release, and the new one dies away quickly. In that case, notes may be cut off abruptly. Many sequencers let you lengthen the note duration, the amount of time that notes are held down. Similarly, a sound with a slow attack may lag behind one with a fast attack. Sequencers make it easy to to compensate for this kind of problem by shifting a track forward or backward in time.

TIMING RESOLUTION

Sequencers always quantize to some small time value because they have to store an exact time for each note or other event. They divide time into tiny, discrete intervals. While you might decide to quantize a passage to eighth notes, the sequencer already has divided the rhythms into some number of subdivisions per quarter-note.

These subdivisions are usually called "pulses," "clocks," or "ticks." The more such subdivisions per quarter-note, the more accurately a sequencer can reproduce the nuances of expressive performance. This figure is known as the sequencer's timing resolution.

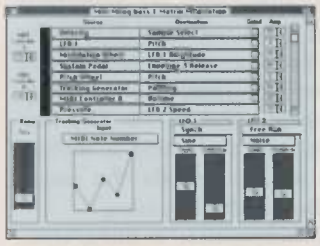
Some early sequencers had a timing resolution of 24 pulses per quarter-note (ppqn), but the practical minimum for today's equipment is 96. Even this is not sufficient to reflect all subtleties of rhythmic inflection, so many sequencers offer resolutions of 192 to 480, or even more, pulses per quarter-note.

NOTE-LEVEL EDITING

All of these examples deal with editing groups of notes, or entire tracks, but it also can be convenient to adjust individual notes. To aid the user, several systems have evolved to display musical data (see Fig. 2). The most common is the event list, describing each note, or other event, in text form. A middle C might be represented as "C4, velocity 123, duration 50," for instance. This nuts-and-bolts approach can be quick for delicate adjustments, and most hardware sequencers use event lists exclusively.

Some other systems use traditional notes, flags, and clefs to represent musical data. While familiar to many musicians, this system is not always the best way to describe electronic music. For example, standard notation is inad-

Grand Sample Station



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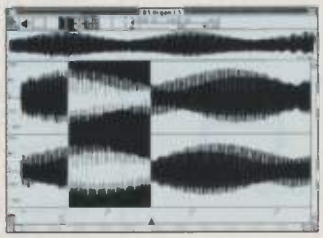

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equate to show information such as "play this note 15 ms before the beat, adding modulation at the same time; increase modulation, add aftertouch, and release the note 47 ms after the beat." Most sequencing programs only offer limited standard-notation displays and do not compete with dedicated music-printing software.

Piano-roll editing displays notes as lines of variable length and position. Vertical position shows pitch, while horizontal position and length show rhythmic placement and duration. Using a mouse, you usually can change a note by simply dragging it to a new position, a method both quick and easy to understand.

Many sequencers allow you to graphically display and edit continuous controllers, such as pitch bend and modulation wheel. A pitch bend movement might be shown as a curve. The pitch bend then can be altered by reshaping the graphic.

COMPOSITIONAL TOOLS

Besides flexibility in editing performance data, sequencers provide power to manipulate an entire composition. Song structure, for instance, can become extremely malleable in a way not possible with multitrack tape. To understand this, let's take a look at two sequencer styles: pattern-song and through composition.

Pattern-song sequencers promote a two-step compositional process. First, individual sections of the composition are created. These then are assembled by stringing them together. While the actual commands vary, this usually is as simple as saying, "Intro, Verse, Verse, Chorus, Bridge," and so on. The one drawback is that each time a section repeats, it sounds exactly the same, which can be less than exciting.

Through-composition, or linear-style, sequencers record in a single, continuous block. If you use a lot of variation and little repetition in your music, this approach may make more sense.

The division is not always so distinct. Some pattern-song sequencers permit patterns of arbitrary length, allowing an entire composition to be recorded as a single unit. Likewise, some linear sequencers allow you to work with "phrase blocks," providing many of the benefits of pattern-song sequencing. Phrase blocks can represent musical units as small boxes, to be dragged and

copied to assemble a composition. This allows a visual approach to song structure; adding an extra chorus or changing the position of the bridge becomes simple.

Most sequencers offer cut-and-paste facilities like those found in word processing. You might decide, for example, that your intro would work better as a coda. Just clip that intro from the beginning and paste it at the end. Also, if you want to use a really blazing lick in several parts of a piece, cut-and-paste makes it easy.

All these techniques allow you to rearrange musical ideas with remarkable speed and convenience. Since you can try out various ideas quickly, you have the freedom to experiment. Maybe you'll discover something you wouldn't have come up with otherwise.

Some sequencers offer more esoteric aids, such as rhythmic augmentation and diminution, melodic inversion, and retrograde. Some also provide semi-automatic "algorithmic composition" options, which can rearrange the notes of a composition in a number of ways.

THE FUTURE

Today's sequencers give musicians a gratifying amount of control over musical information, and significantly ease the compositional process. For the most part, however, they leave acoustic material, such as vocals, guitars, horns, oboes, etc., out in the cold. Thankfully, this is now changing. Equipment is becoming available that allows you to record audio into a computer and edit it as though it were part of a sequence. Several products—including Digidesign's *Deck*, Opcode Systems' *Studio Vision*, Passport Designs' *Audio Trax*, and Mark of the Unicorn's *Digital Performer*—offer integrated audio and sequencing. The future undoubtedly will see more and more of these integrated, "studio-in-a-box" products. By the year 2000, a sequencer that doesn't deal equally well with both audio and MIDI data may seem as outmoded as, well, a player piano.

(For more information on sequencing, MIDI, multitrack recording, and other basic electronic music topics, see the January 1991 issue of EM.)

Dan Phillips *is a computer musician who's still waiting for a guitarist with MIDI inputs. He works as a product specialist for Korg Research and Development.*

Questions and Answers

Our resident Lord of the Electron offers us tips on creative hot-rodding for pre-MIDI dinosaurs, de-humming our racks, and extraterrestrial grounding.

By Alan Gary Campbell

JACK DESROCHER

Q. Is there a way to modify older synths like the Sequential Circuits Prophet 5, Oberheim OB-X, and Moog Memorymoog to incorporate velocity sensitivity? This would really bring the sounds of these units up to date.

A. This remains a topic of great interest among vintage-synth aficionados. Unfortunately, there is no straightforward, off-the-shelf modification that can be retrofitted to such synths to provide velocity sensitivity. Though the instruments in question are *hybrid* synths (combinations of analog and digital technology), the microprocessor capability provided in each is, generally, not sufficient to drive the additional circuitry required; the available capability can be further taxed if a MIDI retrofit is added. To implement such an augmentation would require creating new operating system code; but annotated source code is rarely available, which exacerbates the difficulty to the point of near-impossibility.

Nonetheless, there are some "workarounds" for MIDI-retrofitted hybrid synths that address these requirements. One of my customers wanted to convert his Memorymoog Plus for use as a master controller, as the timbral capabilities of the unit are important in his work, and the circuitry of the unit is too bulky to be rack-mounted conveniently. In this case, I removed the Memorymoog keyboard and replaced it with one from a velocity-sensing Oberheim XK MIDI controller. Then, I cut down the front panel of the XK, rearranged the circuit boards, and put a rack-mount enclosure around the modified assembly; the units were interconnected via a ribbon cable.

The MIDI output was fed back to the Memorymoog Plus for local control, and I "borrowed" the Memorymoog's Pedal 1 Pitch button (a function not likely to be used in the destination system) to provide programmable Local On/Off via an added relay circuit. A dual pot allowed the Memorymoog pitch wheel to control MIDI and internal (analog) pitch-bend, as the Memorymoog Plus does not receive MIDI Pitch Bend data; the mod wheel was rewired to control the XK circuit only, since there isn't room for a dual pot in the mod wheel position, and the Memorymoog modulation amount can be controlled externally via Pedal 2. The "XK Rack" module also contained an added switching circuit to allow a single damper pedal to control the Memorymoog and XK. Though this conversion left the Memorymoog circuits unimproved, in all, the modification provided a functional, space-saving compromise.

A converse modification to make the Memorymoog voices velocity-sensing under external MIDI control, while ignoring the internal keyboard circuit, is also theoretically possible. It occurred to me that in hybrid synths that incorporate IC envelope-generators, there is a delay between an envelope-control event and the beginning of the envelope, due to response-time limitations of the envelope generator ICs. This provides a basis for a velocity retrofit using an external processor and associated circuitry.

Specifically, the external processor would monitor the incoming MIDI data and derive a velocity value from the first-received Note-on command; this value would be stored in a temporary buffer. Meanwhile, the same Note-on command would be sent via a MIDI Thru to the hybrid synth's MIDI In, and the synth circuitry would assign the note to be played to one of its analog voices. The external processor would monitor the envelope-control logic of the synth to determine which of the voices had been assigned, then send the velocity value to the modified control circuitry of the appropriate voice.

The modified control-circuitry might

consist of digital attenuators, one per envelope, inserted in series with the envelope-generator outputs, VCFs, and VCAs to provide velocity-controlled attenuation of the total envelope levels. Alternately, a digital-to-analog converter, multiplexer, and sample-and-hold circuits could be used to control series-inserted analog VCAs. The latter scheme is slower and more parts-intensive, but does provide a DAC that, with additional circuitry, might be used to control other analog functions, such as envelope rates (also derived from MIDI Velocity data), pitch bend, modulation, and instrument volume. Of course, less expansive DAC and sample/hold circuitry could be used as an adjunct to digital attenuators. An unused port, in conjunction with a switching transistor, could control damper pedal function.

With the assistance of a talented colleague, David Hannon, I verified experimentally that this scheme does work with a Memorymoog Plus and therefore should be applicable to other hybrid synths.

Given the magnitude of work required to bring such a scheme to completion, it would certainly be simpler to use a hybrid MIDI synth that already incorporates velocity sensitivity, such as a Roland Super Jupiter module, or an Oberheim Matrix-12, Xpander, Matrix-6, or Matrix-1000. But it just wouldn't be the same, would it?

Q. Where can I obtain one of the rectangular fuseholder caps for a Sequential Circuits Prophet 5? (I believe that this is the same type used on the 360 Systems Midibass.)

A. This type of fuse cap, used on the Prophet 5, Midibass, and many other devices, is manufactured by Littlefuse-Tracor. It is available in red with white lettering, part number 348001; white with black lettering, part number 348005; and black with white lettering, part number 348007. The matching fuseholder body, in black, is part number 348870. Regional electronics suppliers that carry Littlefuse products may stock these parts; if not, a service center can order them for you from a distributor such as Newark Electronics, subject to minimum order requirements.

JUST TEACH IT THE WORDS

A colleague of mine reported that his Yamaha MT100 II multitrack cassette deck had an annoying hum. He had tried several power modules, to no avail, and inspection of the unit disclosed no defects.

Later, he remarked that when he disconnected his *CD player*, the problem disappeared. "Ground loop?" I thought. No. "Leave the CD player connected and move it out of the rack," I instructed. That solved the problem.

Upon addition of the MT100 II, he had rearranged his rack components so that the CD player was too close to his power amp and was inductively coupling 60-cycle EMI. If you encounter hum problems (not caused by ground loops) with rack systems, try rearranging the components. And if it keeps humming, see above.

KORG COMES CLEAN

A customer called, rather upset, and related that his spouse had machine washed and dried his DW-8000 factory data cassette. Unfortunately, his cassette contained different data from my shop copy, and he needed the patches immediately. He desired that I attempt to recover the data. Visual inspection disclosed little apparent damage (the cassette label had bolder colors and whiter whites) and the reels moved reasonably freely. After working the tape through several complete play/rewind cycles, I was, with some effort, able to recover the data and make a tape copy via the DW-8000. You know, my washer has a cycle for delicate loads, but I don't recall one for *cassette* loads.

E.T. GROUND, OKAY?

In a well-intentioned attempt to add even more humor to my already tongue-in-cheek prose, a certain technical editor inserted, in the October 1990 "Service Clinic," a comment to the effect that a partially buried meteorite would make a good ground point for a conductive wrist strap. As a former Sigma Pi Sigma chapter president, I would be remiss not to offer a correction to this somewhat misleading information. Less than ten percent of meteorites of sufficient mass for this purpose contain iron or other conductive materials, so this scheme is untenable. A partially buried flying saucer seems a much better choice.

EM *contributing editor* **Alan Gary Campbell** *is owner of Musitech™, a consulting firm specializing in electronic music product design, service, and modification.*

First Takes

April showers bring an affordable VITC/LTC reader/generator, an ear-training program for the IBM PC, and a sample library on floppy disks.

MOTU Video Time Piece and Video Distribution Amplifier

Mark of the Unicorn Video Time Piece ($1,195)

By Chris Many

The Video Time Piece (VTP) is a high-powered SMPTE reader/generator and character generator for MIDI-equipped, video post-production. Its power and flexibility don't come without a price tag, but if you do video-related work in your studio, take a good look at this product.

This is no run-of-the-mill SMPTE box. The VTP boasts full Vertical Interval Time Code (VITC) capability, in addition to the Longitudinal Time Code (LTC) familiar to most audio users. The VTP reads and writes all SMPTE formats, genlocks to house sync or video, jam syncs SMPTE, and converts SMPTE (LTC or VITC) to MIDI Time Code, VITC to LTC, and LTC to VITC. (Are we acronym-saturated yet?)

LTC is the commonly known form of SMPTE (see "Decoding SMPTE" on p. 62 of this issue). It's the audio format of the SMPTE time code spec, and since it's an audio signal, it occupies one of the VTR's audio tracks.

VITC, on the other hand, is the same SMPTE time code, but it is encoded in the video signal itself, in the vertical blanking segment at the top edge of each frame. A video frame consists of 525 scan lines. The first 24 of these are blank, to provide time for the video trace to move back to the top of the screen. There is no video picture content in these scan lines, and this is where VITC is recorded. Since this is a video representation, no audio track is required.

Another advantage of VITC is its ability to deliver readable time code at especially slow tape speeds, or even when the tape is stopped. LTC requires that tape be moving within a relatively narrow speed range for proper reading. VITC is continuously available to the reader so long as good video picture can be obtained. Current video recorders produce a clear picture even when stopped, so VITC can be used conveniently to identify single video frames.

A standard, single-rackspace unit, the VTP has an on/off switch and a series of LEDs on its front panel to show you what is happening. MIDI In/Out, ¼-inch audio, and BNC jacks (for video connection) are at the back of the unit. Connection is straightforward. Typically, the video signal is routed through

the EM rating system

EM reviews include 11-step "LED meters" showing a product's performance in specific categories chosen by the reviewer (such as ease of use, construction, etc.) and a "VU meter" indicating an overall rating. The latter is *not* a mathematical average, since some categories are more important than others. For example, if a guitar synth has great documentation and is easy to use, but tracks poorly, it could have several high LED meters and a low overall rating.

The rating system is based on the following values, where "0" means a feature is nonfunctional or doesn't exist, while a value of "11" surpasses the point of mere excellence (a rating of 10) and is indicative of a feature or product that is truly groundbreaking and has never before been executed so well.

Please remember that these are opinions, and, as always, EM welcomes opposing viewpoints. We urge you to contact manufacturers for more information, and, of course, tell them you saw it in EM.

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- ☐ People say I sing and/or play out of tune.
- ☐ It's hard for me to transpose songs to new keys.
- ☐ I improvise poorly because I can't envision the tones I want to play.
- ☐ I try to steal "licks" from records, but the tones flash by too quickly.
- ☐ I can't figure out chord progressions without my keyboard.
- ☐ I have all these incredible musical ideas "in my head," but I can't seem to play them without a lot of bad notes.
- ☐ It's embarrassing when I get "lost" and can't find my place.
- ☐ It takes me longer than I like to learn and memorize a new tune.
- ☐ I have difficulty singing harmony.
- ☐ My friends seem to enjoy music more than me because they have a better ear.
- ☐ My playing is caught in a rut that I can't seem to climb out of.

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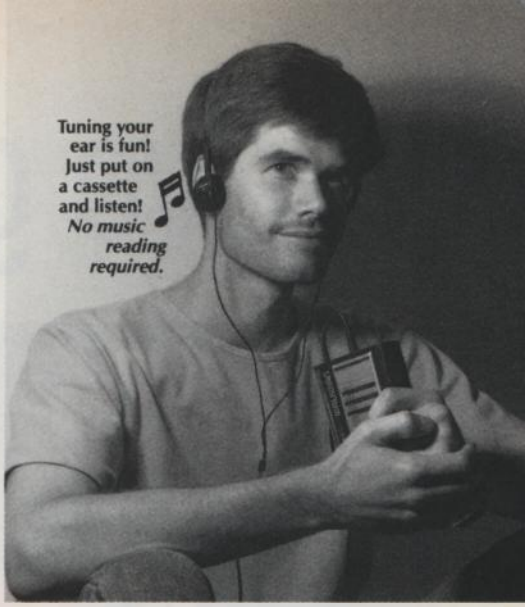

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the VTP. The unit has two sets of MIDI In and Out jacks and supports MTC and Mark of the Unicorn's Direct Time Lock.

Since VITC is part of the video signal, you only can record it at the same time as the video picture; there's no special VITC track. When striping VITC, a video source signal is fed through the VTP into another recording VTR. The VTP adds the VITC as the signal passes through. Once a tape is "striped," the VTP can read time code and display it in real time in a window inserted into the video picture. This "frame reference" is extremely helpful in spotting sound effects and dialog to tape, for instance.

VTP can freewheel up to four seconds over a code drop-out. In other words, it stays synchronized even if the signal is contaminated or drops out completely, and picks it back up when it is clear again. You also can do a one-shot jam sync, i.e., the VTP independently generates SMPTE as soon as it encounters a bad frame.

The VTP uses a Macintosh desk accessory as its graphical interface. Using a computer makes it easy to select settings, type in numbers, and position graphics, but it implies a certain working context. The DA installs easily and allows you to set up and save your basic configuration.

You can display a graphic (bitmap or text) that has been pasted into the VTP's setup screen from your Mac clipboard, and there are a few extra goodies for users of Mark of the Unicorn's *Performer* (version 3.5 or higher). The VTP displays onscreen "streamers," defined in your sequence. (A streamer is a solid white bar that travels from left to right across the screen, reaching the right side at the exact time entered as a "hit point" in the sequence. These are especially useful in helping composers and sound effects engineers anticipate scene changes and dramatic high points.) The VTP also can generate a "Conductor," a series of white blips that travel from right to left in tempo with a musical sequence.

VTP operates according to NTSC or PAL/SECAM standards, in case you need foreign video formats. It also synchronizes to house sync (although it doesn't generate it). This is a critical function for a time-code generator in video post, one lacking in most generators designed for MIDI applications.

One other nice feature that tends to be overlooked is VTP's excellent manual. Neither overwritten nor under-written, Mark of the Unicorn's editors did a great job of describing how everything works, defining terms, and generally making the learning curve a breeze. It's a real pleasure to take a piece of gear out of the box, hook it up, and make it function perfectly just by referring to a well-written manual.

All in all, Video Time Piece is an impressive unit, handling all of its functions simply and effectively. The price is relatively high for a MIDI-oriented time code box, but if you use MIDI to produce sound effects, dialog, and/or music for video, the VTP will meet your needs like no other device on the market.

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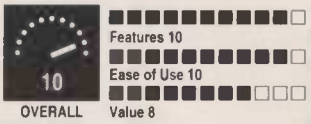

Chris Many *is an L.A.-based composer who, along with partner Geoff Levin, composed the theme to the new Valerie Harper show,* City. *He is also a member of Celestial Navigations.*

Ibis Software Play It By Ear 1.0 ($99.95)

By Peter McConnell

To many musicians, the term "ear training" means something frustrating, dull, or elusive, like trying to learn to be smarter. Everyone would like to *have* better ears, but how do you *get* them? You could hire someone to sit with you one-on-one, every day, and spend a small fortune. Or, if you have an IBM PC, you could buy Ibis Software's *Play It By Ear.*

Ear is a customizable ear-training package that lets you respond immediately to the sound patterns it plays. Patterns are played either as tones (using the PC's internal sound generator), or as MIDI notes (via an MPU-401-compatible interface). In the first case, you respond to patterns using one of the program's screen-drawn virtual "instruments" (a keyboard or guitar neck). Using the MIDI interface is preferable, as you can hear and respond using your own keyboard or MIDI instrument. In either case, a mouse and graphics display are required. If you use a CGA monitor, you lose a few convenience features, but

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Guitar and keyboard entry screens for Ibis Software *Play It By Ear*.

all of the functionality is still available.

Ear is not glitzy-looking, but it's simple to use. All the action takes place on one screen, from which you choose various exercises and options. Pull-down menus at the top of the screen allow you to set anything you need, and button-activated windows give quick access to "current options" relevant to a given exercise. Examples of options are the range and names of notes used and whether the root of a chord, scale, or interval can be chosen from one or more notes. The option settings are grouped into six "levels," providing a simple format in which you progress.

The two types of exercises are *identification*, in which you identify notes, chords, intervals, or scales, and *composition*, in which you play back what you hear using a MIDI, or onscreen (virtual), instrument. Each exercise consists of a number of "drills." The formula for a drill is simple: *Ear* plays a pattern and you respond. If you answer wrong, *Ear* plays the pattern again. In a composition exercise, the program also tells you visually which notes you played correctly and whether the incorrect ones were high or low. This can be helpful if you just want a hint to steer you toward the right answer. You can repeat the pattern at any time, and if you get stuck, ask *Ear* to skip the drill or show you the correct answer with the screen instrument.

Here's an example: Suppose you are having trouble distinguishing between dominant 7th and minor 7th chords. Use the Chord Identity exercise and set the options so that only dominant and minor 7th chords are played. Now you only are identifying whether the chords are of one kind or the other. In this way, the identity exercises let you "home in" on a kind of sound. When you are comfortable doing this, you can move on to the Chord Composition exercise. It has the same parameters, but this time you arpeggiate the chords you hear, from lowest to highest. If you have trouble, you can restrict things by allowing only a couple of roots, or by limiting the range of notes.

Play It By Ear plots your progress during each exercise and maintains cumulative charts of your performance over past sessions. Scores are based on the number of mistakes, response time, and the difficulty of your option settings. If you like, you can print out a chart for each exercise. This should be useful for music schools; up to six people can use one copy of the program with separate progress histories for each user.

If all these exercises and drills make *Play It By Ear* seem dull or regimented, it isn't. You're not in a class; you don't have an instructor to intimidate you. *Ear* is really like a video game in which the higher you score, the better you're hearing—and playing. This is why it's so beneficial to use the program with a MIDI instrument. Since your response time is part of your score, you will learn to find notes and chords quickly on your instrument. This instrumental aspect is very important even if you don't use the MIDI interface. For instance, using the onscreen guitar neck helped me get to know my guitar better.

Ear caters to a broad spectrum of needs and abilities. Level 1 starts with three or four notes of the C scale, and the higher levels get *much* more difficult. I have well-developed relative pitch, and, I feel, a pretty good ear. Even so, I found the Level 6 exercises quite challenging.

The program has a few shortcomings. The chord exercise includes only chords commonly found in jazz. In the scale exercise, you are able to invent your own scales for testing, and it would be nice if you could also do this for chords. Also, the interval exercises include no intervals greater than an octave, a serious omission. I also have some minor complaints about the lack of status indicators (both onscreen and in the printouts) telling you the level you are using. It would also be nice if printouts could be made of your progress over several sessions, as opposed to one for each exercise. The manual is fairly clear and has only a few minor errors. But while it explains the process of calculating your score, nowhere does it say what sort of scale the score is based on or what the highest possible value is.

I experienced no crashes but ran into two small bugs. In one instance, the system got into a state in which the MIDI interface was invisible to the program, and only the internal speaker could be used. Rebooting the system fixed the problem, and it never happened again. In another case, the program played a chord that extended out of the keyboard's range and the program's range settings. Again, this only happened once. I am told by the people at Ibis that both of these problems are being fixed for the next release.

On the whole, *Play It By Ear* is a useful program, and its features are solidly implemented. While I cannot guarantee it will give you perfect pitch, it will help you improve, whether you are a beginner or a virtuoso. Given the reasonable price, any musician should benefit from and enjoy *Play It By Ear.*

Ibis Software
90 New Montgomery St.
Suite 820
San Francisco, CA 94105
tel. (415) 546-1917

Peter McConnell *is a musician and software consultant living in Berkeley, California. He has done work for Lexicon and Lucasfilm Games, plays violin and keyboards for the band Never Land, and runs a music production company, Little Big Note Music.*

Prosonus Prodisk DDD Series Sample Disks for Akai S1000 ($69.95/4-disk set)

By Bill Heagy

You've scrimped and saved your way to the big leagues, and now you're the proud owner of a pro-quality sampler, such as the Akai S1000. But tedious hours of sampling, recording, and editing soon threaten your sanity as you try to assemble a decent sound library. Enter Prosonus's Prodisk DDD series, which offers a variety of instrumental families in 4-floppy disk sets. Drawn from Prosonus's well-known CD sample library (reviewed in the June 1990 EM), the Orchestral Strings and Orchestral Percussion sets proved a convincing alternative to "do-it-yourself" sampling madness.

Sure, you could work directly from the original CDs. But then you'd have to do all the editing and looping yourself (a process explained in "Sampling from CD" in the March 1990 issue). The Prodisk Series disks, which are available for the Akai S900/950 and S1000, E-mu Emax, Ensoniq EPS, Yamaha TX16W, Casio FZ series, Roland S-50/550 and W-30, and Oberheim DPX-1, are designed to implement the specific capabilities of each instrument. For instance, the EPS versions support layers and patch buttons. The objective is to provide easy-to-use, load-and-play samples. Although I needed to adjust some of the S1000 samples, using the Prodisk versions certainly is easier than sampling from compact disc.

The "Orchestral Strings" set includes a selection of sustained, marcato, and pizzicato multi samples, as played by a string section. The samples themselves are generally quite good, with proper levels and seamless loop points, although there is occasional unevenness in some of the adjacent samples. The ranges are well-covered, with intervals of fourths for the looped samples and smaller intervals for shorter samples such as pizzicato. The "Orchestral Sus" programs are particularly excellent, including bow noise and careful use of aftertouch, and the stereo panning provides a better sense of realism than most synth/sample hybrids.

Marcato and pizzicato programs weren't quite as good: I had to tweak keygroups, envelopes, and velocity to even things out. The inclusion of reverb in the samples presents problems

more serious than those of taste, especially in the haziness of the pizzicato samples. But some can be fixed with a little editing of the reflected sound, using individual program envelopes. In spite of some pitfalls, this set remains pretty indispensable.

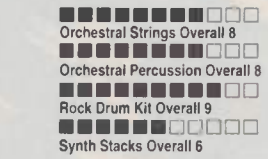
The second set of disks, "Orchestral Percussion," is mainly timpani, with a few different cymbal crashes. Prosonus notes that additional percussion disks are coming for those who want more diverse percussion. Although it specializes in application, the set provides a nice selection of high-quality samples. Three levels of volume, several different ranges, looped rolls, glissandos, and side hits give the timpani programs surprisingly good sound. When you add the programmer's clearly thought-out keygroup performance parameters, velocity switches, and bag of tricks, they're fun to play. At first, I wondered how much I would use these, but I came away with some good ideas. The only problem I encountered was a little noise, which the people at Prosonus suggested might come from the S1000.

A couple of additional disk sets arrived too late to review comprehensively. "Electronic Synth Stacks" contains well-looped, sustained layers of synths and what sound like vocal/string samples. The word that comes to mind is, "Why?" These are clean, boring, and duplicative sounds that any sampler owner probably can beat with an atmospheric patch from an M1, D-50, or VFX. Layered, multiple, PPG wavetable sweeps with a Voyetra or Prophet VS—*that* would be a more exotic "synth stack" that most of us couldn't just dash off at home, and I'd probably buy it.

The "Rock Drum Kits" set, however, is just fabulous. Punchy processed snares, nice hi-hats, solid kicks, clean toms, and some beautiful shimmering crash/ride cymbals are among the samples combined in what are referred to as "Ludwig" and "Tama" kits. This set is a "must have" and a great value.

A larger amount of RAM is recommended if you want to make full use of the sets, even though these disks were monophonic. I have 4 MB in my S1000 and need more to load three full disks out of some of the 4-disk sets. However, if you have the stock, 2-megabyte unit, take heart: Loading individual programs and their related samples doesn't seem to be a problem, which is in line with Prosonus's intention to serve a wide variety of users. Either way, Prosonus has come up with some nice options for those who want to spend more time creating music rather than sampling until they drop.

Prosonus
11126 Weddington St.
N. Hollywood, CA 91601
tel. (800) 999-6191
or (818) 766-5221



Bill Heagy *is an independent filmmaker, composer, and producer based in New York City, who specializes in high-technology arts applications and consultation.*

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ARTIST	TITLE	PART #
a		
Paula Abdul	COLD HEARTED	00296
	STRAIGHT UP	00052
Alabama	MOUNTAIN MUSIC	00166
	DAISY JANE	00497
Animotion	CALLING IT LOVE	00291
Association	ALONG COMES MARY	00460
	CHERISH	00489
	NEVER MY LOVE	00627
Rick Astley	NEVER GONNA GIVE YOU UP	00096
	TOGETHER FOREVER	00781
Atlantic Starr	ALWAYS	00123
Average White Band		
	PICK UP THE PIECES	00869
b		
Babyface	IT'S NO CRIME	00356
	WHIP APPEAL	00977
Anita Baker	BEEN SO LONG	00060
	GIVING YOU THE BEST THAT I GOT	00329
	SWEET LOVE	00059
Basia	PROMISES	00770
Beach Boys	CALIFORNIA GIRLS	00483
Beatles	A LITTLE HELP FROM MY FRIENDS	00952
	ALL MY LOVIN'	00157
	AND I LOVE HER	00960
	BECAUSE (THE SKY IS BLUE)	00964
	CAN'T BUY ME LOVE	00940
	CARRY THAT WEIGHT	00968
	ELEANOR RIGBY	00939
	FOOL ON THE HILL	00953
	GET BACK	00838
	GOLDEN SLUMBERS	00967
	GOOD DAY SUNSHINE	00950
	GOT TO GET YOU INTO MY LIFE	00158
	HERE COMES THE SUN	00962
	HERE THERE & EVERYWHERE	00951
	HEY JUDE	00937
	I SAW HER STANDING THERE	00151
	IF I FELL	00949
	LONG AND WINDING ROAD	00959
	MICHELLE	00936
	NORWEGIAN WOOD	00935
	REVOLUTION	00954
	SHE CAME IN THROUGH THE BATHROOM WINDOW	00965
	SHE LOVES YOU	00934
	SOMETHING	00933
	TAXMAN	00938
	THE END	00969
	TICKET TO RIDE	00948
	TWIST AND SHOUT	01242
	WE CAN WORK IT OUT	00961
	YESTERDAY	00946
	YOU NEVER GIVE ME YOUR MONEY	00966
Beegees	STAYING ALIVE	00682
George Benson	I JUST WANNA HANG AROUND YOU	00015
Marcie Blaine	BOBBY'S GIRL	00475
Michael Bolton	HOW AM I SUPPOSED TO LIVE WITHOUT YOU	00958
	HOW CAN WE BE LOVERS	00973
	THAT'S WHAT LOVE IS ALL ABOUT	00023
Booker T. & M.G.'s	GREEN ONIONS	00840
Boys Don't Cry	I WANNA BE A COWBOY	00565
Bobby Brown	MY PREROGATIVE	00003
	ROCK WIT'CHA	00778
c		
Cameo	BACK & FORTH	00286
Belinda Carlisle	HEAVEN IS A PLACE ON EARTH	00544
Eric Carmen	ALL BY MYSELF	00458
Cars	DRIVE	00139
	LET'S GO	00595
Ray Charles	WHAT'D I SAY	00759
Cher & Peter Cetera	AFTER ALL	00277
Nemen Cherry	BUFFALO STANCE	00274
Chicago	25 OR 6 TO 4	00815
	FEELIN STRONGER EVERY DAY	00524
	YOU'RE NOT ALONE	00118
Gavin Christopher	ONE STEP CLOSER TO YOU	00005
Petula Clark	DOWNTOWN	00516
Phil Collins & Phillip Bailey	EASY LOVER	00520
Creedence Clearwater Revival	BAD MOON RISING	00214
	PROUD MARY	00213
Coasters	POISON IVY	00196
Natalie Cole	PINK CADILLAC	00133
Contours	DO YOU LOVE ME	00176
Cream	BADGE	00468
	WHITE ROOM	00726
Jim Croce	BAD BAD LEROY BROWN	00466
Christopher Cross	RIDE LIKE THE WIND	00659
d		
Terence Trent D'arby	WISHING WELL	00199
Dave Clark Five	ANY WAY YOU WANT IT	00463
	BECAUSE	00471
Spencer Davis	I'M A MAN	00990
Taylor Dayne	DON'T RUSH ME	00170
	TELL IT TO MY HEART	00051
El De Barge	SOMEONE	00047
Chris De Burgh	LADY IN RED	00016
Dead Or Alive	COME HOME WITH ME BABY	00297
Neil Diamond	LOVE ON THE ROCKS	00121
Dion	RUNAROUND SUE	00663
Dion & Belmonts	THE WANDERER	00207
Thomas Dolby	AIRHEAD	00457
Don & Juan	WHAT'S YOUR NAME	00155
Doobie Brothers	WHAT A FOOL BELIEVES	00723
Double	CAPTAIN OF HER HEART	00485
Drifters	UNDER THE BOARDWALK	00153
Duran Duran	ALL SHE WANTS IS	00278
e		
Eagles	ALREADY GONE	00202
Eighth Wonder	CROSS MY HEART	00299
Erasure	CHAINS OF LOVE	00294
Gloria Estefan	GET ON YOUR FEET	00771
	HERE WE ARE	00974
Betty Everett	SHOOP SHOOP (IT'S IN HIS KISS)	00152
Everly Brothers	BYE BYE LOVE	00169
Every Mother's Son	COME DOWN TO MY BOAT	00490
Expose	SEASONS CHANGE	00405
f		
Fine Young Cannibals	GOOD THING	00330
	SHE DRIVES ME CRAZY	00411
Roberta Flack	MAKING LOVE	00613
Fleetwood Mac	AS LONG AS YOU FOLLOW	00283
Foreigner	I DON'T WANT TO LIVE WITHOUT YOU	00084
Four Seasons	DAWN (GO AWAY)	00501
	DECEMBER 1963 (OH WHAT A NIGHT)	00632
Four Tops	BABY I NEED YOUR LOVIN'	00182
	I CAN'T HELP MYSELF	00181
Glen Frey	THE HEAT IS ON	00110
g		
Giant Step	ANOTHER LOVER	00280
Al Green	LET'S STAY TOGETHER	00596
Lee Greenwood	GOD BLESS THE USA	00078
h		
Hall & Oates	I CAN'T GO FOR THAT	00558
	KISS (IS) ON MY	00590
	PRIVATE EYES	00652

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—Jim Aikin, Keyboard Magazine October 1990

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ARTIST	TITLE	PART #
WILBERT HARRISON	KANSAS CITY	00210
HEART	THESE DREAMS	00193
	WHAT ABOUT LOVE	00115
HEATWAVE	ALWAYS & FOREVER	00461
DON HENLEY	THE BOYS OF SUMMER	00108
HOLLIES	AIR THAT I BREATHE	00456
BUDDY HOLLY	NOT FADE AWAY	00148
	PEGGY SUE	00150
	THAT'LL BE THE DAY	00149
BRUCE HORNSBY	MANDOLIN RAIN	00094
	THE VALLEY ROAD	00111
	THE WAY IT IS	00112
WHITNEY HOUSTON	HOW WILL I KNOW	00172
	LOVE WILL SAVE THE DAY	00054
	ONE MOMENT IN TIME	00053
	SO EMOTIONAL	00055
	WHERE DO BROKEN HEARTS GO	00442
HUEY LEWIS & THE NEWS		
	HEART OF ROCK & ROLL	00007
	HIP TO BE SQUARE	00008
	I WANT A NEW DRUG	00086
	PERFECT WORLD	00006
I		
BILLY IDOL/TOMMY JAMES		
	MONY MONY	00212
INXS	NEED YOU TONIGHT	00380
J		
JANET JACKSON	MISS YOU MUCH	00375
	WHAT HAVE YOU DONE FOR ME LATELY	00198
MICHAEL JACKSON	BAD	00820
	BILLIE JEAN	00473
	THE WAY YOU MAKE ME FEEL	00021
AL JARREAU	LET'S PRETEND	00092
	MORNING	00046
	RAGIN' WATERS	00100
JETS	CURIOSITY	00498
BILLY JOEL	ALLENTOWN	00459
ELTON JOHN	BITCH IS BACK	01021
	CLUB AT THE END OF THE STREET	01023
	DANIEL	00500
	GOODBYE YELLOW BRICK ROAD	00536
ELTON JOHN & ARETHA FRANKLIN		
	THROUGH THE STORM	00048
JOHNNY HATES JAZZ	SHATTERED DREAMS	00103
HOWARD JONES	THINGS CAN ONLY GET BETTER	00703
K		
JOHNNY KEMP	BIRTHDAY SUIT	00289
BEN E. KING	STAND BY ME	00879
KOOL & THE GANG	CELEBRATION	00488
L		
STEVE LAWRENCE	GO AWAY LITTLE GIRL	00533
GARY LEWIS	COUNT ME IN	00494
JERRY LEE LEWIS	WHOLE LOTTA SHAKIN GOIN ON	00271
LITTLE ANTHONY & THE IMPERIALS		
	GOING OUT OF MY HEAD	00211
LITTLE EVA	DO THE LOCOMOTION	00604
KENNY LOGGINS	FOOTLOOSE	00019
LOGGINS & MESSINA	YOUR MAMA DON'T DANCE	00745
LOS LOBOS	LA BAMBA	00206
M		
MADONNA	BURNIN' UP	00068
	WHO'S THAT GIRL	00203
BARRY MANILOW	COULD IT BE MAGIC	00493
RICHARD MARX	ENDLESS SUMMER NIGHTS	00074
	HOLD ON TO THE NIGHT	00081
	RIGHT HERE WAITING	00395
MARY JANE GIRLS	IN MY HOUSE	00132
JOHNNY MATHIS	MISTY	00189
BILL MEDLEY & JENNIFER WARNES		
	(I'VE HAD) THE TIME OF MY LIFE	00275
PAUL MCCARTNEY	MAYBE I'M AMAZED	00941
MIAMI SOUND MACHINE		
	ANYTHING FOR YOU	00281
	BAD BOYS	00065
	BETCHA SAY THAT	00058
	ONE TWO THREE	00057
	WORDS GET IN THE WAY	00116
GEORGE MICHAEL	FAITH	00011
	FATHER FIGURE	00194
	ONE MORE TRY	00387
GEORGE MICHAEL & ARETHA FRANKLIN		
	I KNEW YOU WERE WAITING FOR ME	00049
BETTE MIDLER	THE ROSE	00204
	WIND BENEATH MY WINGS	00032
MIKE & THE MECHANICS		
	SILENT RUNNING	00205
	THE LIVING YEARS	00120
MILLI VANILLI	BABY DON'T FORGET MY NUMBER	00285
	BLAME IT ON THE RAIN	00914
	GIRL YOU KNOW IT'S TRUE	00327
MITCH RYDER & THE DETROIT WHEELS		
	DEVIL - BLUE DRESS / GOOD GOLLY MISS MOLLY	00180
MONKEES	I'M NOT YOUR STEPPIN' STONE	00572
VAN MORRISON	MOONDANCE	00188
MR. MISTER	BROKEN WINGS	00067
	KYRIE	00090
N		
EDIE BRICKEL & NEW BOHEMIANS		
	WHAT I AM	00215
O		
SINEAD O'CONNOR	NOTHING COMPARES 2 U	01001
BILLY OCEAN	CARIBBEAN QUEEN	00487
	GET OUTTA MY DREAMS	00164
	WHEN THE GOING GETS TOUGH	00061
ROY ORBISON	CRYING	00167
K.T. OSLIN	DO YA	00072
	HOLD ME	00050
DONNY OSMOND	SOLDIER OF LOVE	00033
P		
ROBERT PALMER	ADDICTED TO LOVE	00185
	SIMPLY IRRESISTABLE	00105
PAUL REVERE & THE RAIDERS		
	HUNGRY	00034
	INDIAN RESERVATION	00036
	KICKS	00035
PEBBLES	MERCEDES BOY	00056
	TAKE YOUR TIME	00979
WILSON PICKETT	IN THE MIDNIGHT HOUR	00850
	KNOCK ON WOOD	00040
BOBBY (BORIS) PICKETT & KRYPT KICKERS		
	MONSTER MASH	00168
PLAYER	BABY COME BACK	00997
POINTER SISTERS	NEUTRON DANCE	00156
POLICE	EVERY BREATH YOU TAKE	00076

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ARTIST	TITLE	PART #
Elvis Presely	HEARTBREAK HOTEL	00942
	BLUE SUEDE SHOES	00197
	BURNING LOVE	00480
	DON'T BE CRUEL	00195
	LOVE ME TENDER	00943
	RETURN TO SENDER	00657
	TUTTI-FRUTTI	00160
Prince	BAT DANCE	00786
	POP LIFE	00134
R		
Ready For The World		
	OH SHEILA	00154
Regina	BABY LOVE	00465
Restless Heart	A TENDER LIE	00062
	BLUEST EYES IN TEXAS	00066
	CALM BEFORE THE STORM	00069
	YOU'VE LOST THAT LOVING FEELING	00119
Lionel Ritchie	DANCING ON THE CEILING	00499
	RUNNIN' WITH THE NIGHT	00012
	SAY YOU SAY ME	00747
Roachford	CUDDLY TOY (FEEL FOR YOU)	00276
Linda Ronstadt & Aaron Neville		
	DON'T KNOW MUCH	00916
S		
Sade	SWEETEST TABOO	00161
Sam & Dave	SOUL MAN	00039
Neil Sedaka	CALENDAR GIRL	00482
Bob Seger	SHAKEDOWN	00102
Sonny & Cher	BEAT GOES ON	00470
Ronnie Spector	BE MY BABY	00136
Spinners	COULD IT BE I'M FALLING IN LOVE	00492
	I'LL BE AROUND	00569
Bruce Springsteen	DANCING IN THE DARK	00141
Steely Dan	DO IT AGAIN	00509
	FM (NO STATIC AT ALL)	00834
	JOSIE	00852
	PEG	00641
	RIKKI DON'T LOSE THAT NUMBER	00753
Steppenwolf	BORN TO BE WILD	00477
Sting	SISTER MOON	00106
	WE'LL BE TOGETHER TONIGHT	00787
Barbara Streisand	EVERGREEN	00075
Donna Summer	BAD GIRLS	00467
	THIS TIME I KNOW IT'S FOR REAL	00272
Supremes	BABY LOVE	00184
Swing Out Sister	BREAKOUT	00201
T. Rex	BANG A GONG (GET IT ON)	00469
Temptations	THE WAY YOU DO THE THINGS YOU DO	00177
Three Dog Night	MAMMA TOLD ME NOT TO COME	01028
T		
Tiffany	ALL THIS TIME	00279
	COULD'VE BEEN	00491
	I THINK WE'RE ALONE NOW	00346
Tone Loc	FUNKY COLD MEDINA	00273
Toto	PAMELA	00098
Turtles	HAPPY TOGETHER	00542
U		
Luther Vandross	ANY LOVE	00002
	GIVE ME THE REASON	00530
	SHE WON'T TALK TO ME	00001
W		
Wang Chung	EVERYBODY HAVE FUN TONIGHT	00077
Waterfront	CRY	00300
Wham	CARELESS WHISPER	00486
	WAKE ME UP BEFORE YOU GO-GO	00717
Whitesnake	HERE I GO AGAIN	00080
Wild Cherry	PLAY THAT FUNKY MUSIC	00645
Andy Williams	CAN'T GET USED TO LOSING	00484
Hank Williams Jr.	EARLY IN THE MORNING, LATE AT NIGHT	00073
Steve Winwood	HIGHER LOVE	00754
	WHILE YOU SEE A CHANCE	00887
Stevie Wonder	SIR DUKE	00679
	YOU ARE THE SUNSHINE OF MY LIFE	00179
Z		
ZZ Top	LEGS	00091

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ARTIST	TITLE	PART #
BIG BAND SELECTIONS		
Count Basie	APRIL IN PARIS	01253
Les Brown	HOW HIGH THE MOON	01019
	LEAP FROG	01016
Jimmy Dorsey	DON'T GET AROUND MUCH ANYMORE	00932
	SO RARE	00931
Les Elgart	BANDSTAND BOOGIE (AM B/S THEME)	00822
Duke Ellington	PERDIDO	00930
	TAKE THE "A" TRAIN	00782
Benny Goodman	DON'T BE THAT WAY	00972
	STOMPIN' AT THE SAVOY	00971
Woody Herman	FOUR BROTHERS	00955
Henry Mancini	PETER GUNN THEME	00868
Glenn Miller	GETTING SENTIMENTAL OVER YOU	00957
	IN THE MOOD	00755
	LITTLE BROWN JUG	00956
	TUXEDO JUNCTION	00912
CLASSICAL SELECTIONS *		
Bach	BRANDENBURG CNCRTO #3 IN G	00783
	BRANDENBURG CNCRTO #4 IN G	00790
	BRANDENBURG CNCRTO #5 IN D	00793
	BRANDENBURG CNCRTO #6 IN Bb	00796
	JESU JOY OF MANS DESIRE	00244
	PRELUDE & FUGUE #01 - #06	00245
	PRELUDE & FUGUE #07 - #12	00251
	PRELUDE & FUGUE #13 - #18	00257
	PRELUDE & FUGUE #19 - #24	00263
	TWO PART INVENTION #1 - #15	00799
Beethoven	QUARTET #7 1st Mvt.	00947
Mozart	EINE KLEINE NACHTMUSIK 1st MVT	00784
Pachelbel	PACHELBEL'S KANON IN D 1st Mvt	00785
Scarlatti	SCARLATTI- 8 PIANO SONATAS (EARLY PERIOD)	00975
	SCARLATTI- 8 PIANO SONATAS (LATER PERIOD)	00976
Igor Stravinsky	L' HISTOIRE DU SOLDAT(DANSE DU DIABLE)	01257
	L' HISTOIRE DU SOLDAT(MARCH DU SOLDAT)	01254
	L' HISTOIRE DU SOLDAT (MARCHE ROYALE)	01255
	L' HISTOIRE DU SOLDAT (PETIT CONCERT)	01256
Vivaldi	FOUR SEASONS-L'AUTUNNO	01267
	FOUR SEASONS-PRIMAVERA	01265
	FOUR SEASONS-L'ESTATE	01266
	FOUR SEASONS-L'INVERNO	01268

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Ensoniq EPS-16 Plus Digital Sampling Workstation

By Gary Hall

Those marvelous mavens of Malvern bid to redefine the sampler, with built-in effects, ultra-high-quality sound, and more.

Ensoniq is a company whose products inspire fierce loyalties. (What other manufacturer's customers would publish their own magazine?) From their suburban Philadelphia headquarters, the company has repeatedly brought new concepts and new levels of performance to electronic musical instruments. Ensoniq products always seem to go one step further, and though they sometimes demand a bit more of the user, the effort is usually worthwhile.

In 1985, samplers were just getting established as mainstream instruments. But there was one fly in the ointment: The least-expensive sampler still cost several thousand dollars. Along came (then-unknown) Ensoniq, and with one blow, the entry cost of sampling dropped about 80%. For all that, the Mirage offered most features of the more expensive units. Where compromise was unavoidable, Yankee ingenuity (in the form of a superbly engineered sample library) got more mileage from the instrument than anyone would have thought possible.

But science marches on, and before too long, the Mirage was just one of several budget samplers. In 1988, Ensoniq unveiled the EPS (Ensoniq Performance Sampler) and changed the tilt of the playing field again. Deciding that head-on price competition with Japan was futile, they brought out a mid-priced, high-performance instrument with innovative features to suit working musicians.

That strategy paid off. The EPS has become one of the most popular sampling instruments of all time. Thousands of musicians have benefited from its sound quality, flexible architecture, and innovative performance features.

Now, Ensoniq brings us their third major sampling product, the EPS-16 Plus. Rather than design a new instrument from the ground up, they have chosen to build on the base of user experience and good will from the original EPS, preserving its features and user interface, while improving the sound quality and adding major new features. The "Plus" designation is well-earned.

Ensoniq EPS-16 Plus with Eltekon SX-2 Removable Hard Drive

DOUBLE PLUS GOOD

Readers not familiar with the original EPS should read EM's review in the March 1988 issue. To that already impressive list of features, the 16 Plus adds:

- High-quality, 16-bit A/D and D/A converters
- An improved keyboard
- Dynamic stereo effects processing (a first for a sampler)
- Expanded RAM
- Optional nonvolatile sample memory (a first *anywhere*)
- An enhanced sequencer

For all the improvements, the 16 Plus loads and plays all EPS sounds and even converts Mirage samples from floppy disk. Now *that's* upward compatibility.

Let's look at these enhanced features and see how they integrate with those of the existing product.

AUDIO IMPECCABILITY

The 16 Plus uses 16-bit linear converters, with oversampling for both inputs and outputs (the original EPS used 13-bit converters). The specs are listed as 100 dB signal-to-noise ratio, 96 dB dynamic range, and no more than .002% THD for samples played back without pitch change. No specs are given for transposed samples. Input sample rates range from 11.16 kHz to 44.64 kHz, and the playback sample rate can range as high as 78.13 kHz. Different sample rates give the usual linear tradeoff in sample time and frequency response (the best response is listed as 2 to 20 kHz). The EPS offers higher playback rates than most samplers, although fewer voices are available when this is done. There are twenty voices available when the sample rate is 30 kHz or less (all sample rates are rounded off from this point forward), and it goes as low as seven voices for the 78 kHz rate (this rate improves the fidelity of transposed samples, although the frequency response is still 20 kHz). The original EPS also suffered from some problems with its output circuits that have been fully corrected in the 16 Plus.

The audible sound quality is crystal clear. Using a sample rate of 45 kHz, I detected no difference between the input and output of the converters. I recommend the 30 kHz playback rate for general use. This gives the user a full twenty voices to work with, and the sampling time will be adequate for most applications. It's my experience that few musical sources have audible content above 15 kHz. When you run into one that does, you always can use one of the higher rates.

As mentioned before, the 16 Plus can load all EPS disks. Ensoniq designed the original product to store samples in 16-bit format (even though the converters only yielded 13 bits), and Ensoniq developed their own library disks on an in-house 16-bit system. As a result, original EPS library disks reveal full 16-bit quality when loaded into the 16 Plus. User-sampled and third-party sounds will still be 13-bit, although the 16 Plus's enhanced circuits may improve the sound a bit.

The original EPS keyboard was capable of great expression, with its polyphonic aftertouch features, but it had a feel that bothered a good many users. The keys produced an audible "clack" at the bottom of travel, and they felt a bit mushy when pressed. The 16 Plus keyboard overcomes all of these obstacles. The feel and travel of the keys resembles that of any other high-quality, spring-loaded keyboard. There is a slight travel when aftertouch is engaged, but not so much as to bother the player. We finally have a solid, general-purpose synth keyboard that implements poly key pressure in a satisfying way.

HIGHLY EFFECTIVE

The most striking new feature of the 16 Plus is its onboard effects processor. Though built-in effects have become standard for synths and workstations (including Ensoniq's VFX[sd]), this is the first time that a sampler has included them, and it's a major step forward. Built-in effects are one reason why instruments such as the Korg M1 became so successful. Properly programmed, they can make even mediocre instruments sound good and a good instrument sound incredible.

Thirteen effects algorithms are designed into the EPS-16 Plus ROM effects, divided into single, dual, and triple effects. One algorithm (CMP+DIST+REV) actually has five effects. Each effect has four variations, so there are 52 distinct preprogrammed effects available to the user.

Although the 16 Plus uses a single effects processor, it has provisions for multiple signal insertion points so that different instruments can use different stages of an effect simultaneously. The manual is less than explicit on some of the details, implying one thing in a block diagram and something else in the descriptions of the parameters for the individual effects. Ignore the block diagram on pp. 4 to 7.

Each effect can be extensively adjusted, and the parameter names are self-descriptive. For each algorithm, a single parameter (such as Reverb Mix or Flanger Feedback) can be modulated by an external control source. This can be an on-board controller such as the patch select button, or it can be a MIDI control function.

In general, the effects sound very good. Single-effect reverbs are clear and uncolored, with a good spatial spread in the Hall algorithm. The Room program is as good as any I've heard. The quality of reverb deteriorates when one uses a multiple effects algorithm. This is normal when multiple effects are run on a single processor, but it gets a little out of hand in the triple-effect algorithms. The distortion is good, but not great. In the realm of algorithms, I really wish the wah had come after the distortion.

Compared with effects on other instruments, the processing on the 16 Plus has its advantages and disadvantages. Many onboard effects systems use dual-processor architectures; that is, there are two completely separate processing units available. The 16 Plus uses a single processor, and though the use of insertion points is ingenious, versatility inevitably suffers. One must accept deterioration in reverb when using multiple effects, and some of my favorite effects (such as DDL following flanging) aren't possible with the algorithms currently implemented. I've been looking forward to *more* processors, not less, on an instrument, so it seems like a step backward in this regard. (Of

Product Summary

PRODUCT:
EPS-16 Plus
TYPE:
Digital Sampling Workstation
MAIN FEATURES:
16-bit A/D-D/A conversion with oversampling; 20-voice polyphony; 16-track sequencer (8 sequence tracks, 8 song tracks); polyphonic aftertouch keyboard; built-in effects processing; 1 MB (expandable to 2 MB) standard sample memory; optional nonvolatile (flash) sample memory; optional SCSI port; optional multi-output expander
PRICE:
Keyboard, $2,395; module, $2,495; 2x Memory Expander, $229.95; SCSI Port Kit, $199.95; Flashbank Programmable ROM 512K, $349.95; 1 MB: $649.95; OEX-6 Output Expander, $249.95
MANUFACTURER:
Ensoniq Corp.
155 Great Valley Pkwy.
Malvern, PA 19355
tel. (215) 647-3930

Features 10
Ease of Use 6
Value 8

course, there is no other *sampler* thus far that gives me even one processor, so maybe I'm being too tough. I do expect that situation to change, though.) The single processor is probably adequate for live performance, but I would recommend that you get the multi-output expander and a couple of good outboard processors if you intend to do a lot of sequencing.

The 16 Plus does offer a unique feature that could partially offset the disadvantages of the single processor. It can *resample* a sound with the effects added. Having done this, the effect is always there. I was able to create some really nice ambient drum kits using this function.

But there's no free lunch. After resampling, there can be no further adjustments to the effect, and you can forget changing parameters dynamically. Also, the effects will consume additional sample memory. This could be a *lot* of memory if you want a long decay, and it will be repeated for every sample in a multisampled instrument. Transposition also can change the sound of an effect, and this might force you into additional multisampling. Finally the 16 Plus samples in mono. If you resample with an effect, all of the stereo of that effect will be gone. Most time-base effects depend on stereo for their full impact, so this is a major loss. You could make two samples, one for left and one for right, but this would eat up even more memory.

The 16 Plus also has the unique ability to load new effects from disk, including additional effects algorithms. If Ensoniq is aggressive about this, you could find yourself with a new effects library at some future point. This is an innovation that I heartily applaud.

NEWS FLASH

The other big innovation on the 16 Plus is its optional nonvolatile sample memory. Ensoniq calls this memory Flashbank, and it's available in 512K and 1 MB sizes. These use a type of programmable memory (appropriately known as "flash" memory) that reads like conventional RAM but requires longer to write. Flashbank memory is in addition to, not in place of, conventional sample RAM. Thus, the 16 Plus can have as much as 3 MB of sample memory installed.

Flash memory appears as another storage device, like a disk drive, except that you don't lose any of the regular sample memory when you load an instrument. Ensoniq chose this system to preserve the flexibility of assigning and layering samples. Flash memory cannot be used to record new samples, and instruments in the flash memory must be brought into regular RAM to be edited, because of the flash write cycle (much longer than that of conventional RAM).

The operating system software, normally loaded from disk, also can be stored in the Flashbank, yielding a really fast boot-up, and freeing you from ever seeing the "INSERT OS DISK" prompt. This consumes a sizable chunk of the flash memory, so you may or may not elect to use it that way under normal circumstances.

The operating system speed can be advantageous when editing samples, however, and because you can't edit samples in the flash memory anyway, it could be a good idea to load the operating system into the Flashbank when sampling or creating new instruments.

You also could load the Flashbank with your favorite "bread-and-butter" sounds, fill the regular RAM with other sounds, and keep the operating system disk in the drive. Of course, you could put the

operating system *and* your core instruments in flash memory. Then you could dispense with floppies altogether (although you wouldn't have many instruments available) when you chose to. Incidentally, if you are using a hard disk, you might pass on the flash memory. I feel that hard disks are fast enough to offer you *most* of the advantages of the flash memory.

Not to forget, the 16 Plus has 1 MB of sample memory as standard (compared to 480K for the original EPS), expandable to 2 MB. This isn't quite as much of an expansion as it appears, because the Plus uses more bits per sample. The sampling time available at any given sample rate is exactly twice that of the basic EPS.

SEQUENCER HEAVEN

The improvements to the sequencer section could be summed up as "two of everything, please." That's twice the memory capacity (from 80,000 to 160,000 note max without expander), and twice the timing resolution (from 48 to 96 parts-per-quarter-note).

On the memory side, the improvement is actually a bit better than double. A full 160,000-note capacity is available with the basic memory. If you add the ME-16 Plus memory expansion, it doubles again to a whopping 320,000 events.

A Multi-Track Record feature has been added so that an external sequencer can transfer its contents into the 16 Plus in a single pass. This makes it considerably easier to transfer your computer-edited sequences into the EPS for gigging. Huzzah.

Ensoniq's initial publicity listed "the ability to load samples even while the sequencer is playing" as a feature. This capability had not yet materialized in the operating system I had for review (version 1.1). According to Ensoniq, it should be available soon, and they have a good record of delivering on their promises.

THE SCSI THING

The optional SCSI adapter allows you to attach any kind of mass-storage device, such as a hard-disk or CD-ROM. Ensoniq was kind enough to provide the review unit with a 45 MB removable hard-disk cartridge drive made by SyQuest and packaged for rack-mounting by Eltekon Technologies (Model SX-2 $1,299; tel. [313] 462-3155). Peachier still, they gave us a cartridge chock-full of demo samples and sequences.

To me, a hard-disk loaded with samples is just about the greatest enhancement imaginable for a sampler. I found it perplexing, then, that when I loaned the 16 Plus and its drive to two friends who have original EPS's, neither one bothered to connect the hard disk. I guess old habits die hard, but I would no more have considered doing that than I would willingly disconnect the hard disk from my computer. Interesting.

With the drive connected, I was all set to zip around loading samples, sequences, and banks with wild abandon. But it was not quite that simple, at least to start with. It took me a while to adapt to the system of accessing files and directories and to the way that files were arranged on the hard disk volume that Ensoniq gave me.

A disk is divided into *directories* and four different kinds of *files* (instruments, sequences, banks, and sysex). Individual directories can contain any combination of up to 38 files and other directories, but you only can access *one* of the five types of data at a time. To navigate from directory to directory, one must enter a mode in which *only* directories can be viewed. Once you find your way to the directory

you want, you press Enter and then press a key to access files in that directory. If you select a file type that is not present in the current directory, you get a message such as "No Instruments Available." This could be handy information to have, but it can be aggravating if you are trying (as I was) to browse through a preloaded volume of material. As it happens, Ensoniq had segregated the material they provided into separate directories of instruments, sequences, and banks. The result for me (the naive user) was that I got to see the "No Instruments" message a lot. Although I finally got the hang of the scheme, I found the constant switching between modes to be a nuisance, and every so often, I forgot to press "Enter" and found myself in someplace other than Kansas.

Ensoniq points out that a user probably will load the disk with material he or she selects, and thus be familiar with the organization of the disk, having created it. However, mass storage devices have an equally important role to play in distributing prepackaged libraries, as in CD-ROM. In that case, the organization is built into the product (as it was for the removable cartridge that Ensoniq provided), and good documentation will be vital.

Once I got past this obstacle, the hard-disk system worked just fine. Loading is fast, and I spent hours cruising among the files provided by Ensoniq.

One thing I like about the EPS is that a group of sounds and a sequence can be stored and loaded as a single unit, and all of the Ensoniq library sounds have a sequence that demonstrates their use. Imagine if every voice in every sound library for every instrument came with a few sequenced bars to show what the programmer had in mind. Often, a sound fails to inspire simply because the customer doesn't know how it was intended to be used. Play a few bars, and you know what this sound is about. It beats trying to reduce performance notes to an 11-character label.

TAMING THE BEAST

Get out the whips and chairs. I admit to a bit of difficulty in using the 16 Plus, and I don't think it's just me. The original EPS was highly innovative in its features and equally innovative in the user interface, taking advantage of alphanumeric displays and backlit labels to help users navigate through various pages of commands and parameters. Even so, the EPS pushed the boundaries of the system used, and in some cases it showed evidence that the panel had been designed before the software was complete (some of the editing pages are in fairly arbitrary places). It didn't really exceed the limits of its interfaces, it just pushed them hard. The functionality it offered made it a fair trade.

Since then, however, there has been a lot of progress in user interfaces, particularly using larger displays to guide the operator through the various branches of a system and display multiple parameters on a single page. Most companies have used some variation of this idea to make complex instruments reasonably easy to use even without a reference manual. Ensoniq's own VFX and VFX^{SD} make good use of this approach.

In the 16 Plus, Ensoniq clearly chose to preserve the basic EPS interface, grafting new features onto the existing system wherever space could be found. (The exception is the effects. The Set Keyboard Range button was reassigned and renamed to support these, and it makes a huge difference.) Since the original in-

strument had already extended its interface to the edge of reason, the result is a product that is more difficult to get going with than I think necessary. There are a number of shortcuts in the system, true, but even these are quite singular and must be remembered individually.

The owner's manual is less helpful than it might be for the poor wandering soul. Generally, the information is there, but the question is, "Where?" The manual spends too much time explaining *what*, and not enough explaining *how*. These days, most of us know what sampling is, and the EPS's unique features can be explained with a few words. What I really needed was some material that said, "To do *this, do that.*" I would have greatly appreciated a quick-reference card.

The 16 Plus is an instrument that will be easily mastered by previous EPS owners (just add a few functions to those already learned) but may be a bit opaque to those who lack that previous experience. My feeling is that Ensoniq missed a chance to rethink the system from the ground up. Clearly, a decision was made early on to go for continuity with the original instrument, and perhaps this was the right decision to make. Only time will tell.

GETTING THERE

If you are an EPS owner, you have probably already heard the news: no upgrade path. If you want a 16 Plus, you must buy it outright. This is only reasonable, considering the extensive hardware changes, but it may not seem so to those who invested heavily in their EPS. After all, it looks and acts like an EPS, doesn't it?

Will EPS owners flock *en masse* to sell their units so they can get the better box? I'm not at all sure. Full-time professionals who have recouped their investment and then some should have no problem. But I suspect that many EPS owners are semi-pros and hobbyists for whom the EPS was a major investment. These folks may not find it easy to think about making a purchase of that size again. If you don't own an EPS already, of course, there's no issue, except that you will have to climb the learning curve from the ground up.

SO, IS THIS THING COOL OR WHAT?

On the one hand, yes, and on the other hand, well, no. To me, the 16 Plus is a sampler of remarkable capability, but it labors under a difficult operating system. I frequently found myself frustrated trying to do something that I felt should be obvious. At those times, I would go over to one of my other instruments and engage in some cheerful play and a little programming. This action highlighted the comparative difficulty of the EPS's user interface. (In fairness, the EPS does things that nothing else I have can.)

Had I lived with the instrument exclusively for a while, I would no doubt feel differently, so I hesitate to be too critical. Still, the 16 Plus is a separate instrument that must stand on its own. After all, you must buy it separately, though it looks the spitting image of its forebear.

The EPS-16 Plus sounds wonderful, has good built-in effects, an on-board sequencer as good or better than any I know of, performance and expression features that are (still) unequaled by the competition, and a nonvolatile memory option that you just can't get anywhere else. Though I have expressed my reservations about the user interface, I must acknowledge that this is a powerful beast. If you are comfortable working with it, I see no reason not to adopt it with enthusiasm.

Gary Hall *dwells in picturesque solitude on a fog-swept island off the wild and rugged shore of our most populous state.*

Yamaha TG33 Vector Synthesizer

By Charles Clouser

Yamaha brings vector synthesis to a new price range and body style with this tabletop unit.

Ground-breaking synth manufacturer Sequential Circuits, which dissolved in 1988, managed to invent a new type of synthesis before going under. Sequential's Prophet VS was the first real "vector synthesizer." It had four digital oscillators mixed with a joystick, and a "mix envelope" that let you, in effect, "sequence" a 4-segment joystick movement, creating tonal changes ranging from delicate to violent. Its sound was reminiscent of, but more versatile than, the PPG Wave synths, and it was much easier to program.

When Sequential folded, a lot of rumors went around that Yamaha or Korg had hired the VS's designers and would someday release their version of a vector synth. In the end, both companies worked with the VS's designers and released synthesizers that incorporate Sequential's innovations. Korg's Wavestation (reviewed in the November 1990 EM) is the closest thing to a Prophet VS for the 1990s, but Yamaha's SY22 (also reviewed in November 1990) and TG33 offer similar, though less subtle, sonic capabilities for a lot less money.

Both the SY22 keyboard and the tabletop TG33 tone generator offer sampled sounds and FM in a unique variation on the vector-based, oscillator-mixing schemes employed in the VS and Wavestation. On test here is the TG33 module, which offers 32-voice, 16-part multitimbral operation for under $600.

THE ELEMENTS

Yamaha has kept the TG33's voice architecture relatively simple, with four digital oscillators ("Elements") mixed via the joystick and Level Vectors (essentially a joystick envelope), and sent through a single, preset-only digital effect. Each single voice in the TG33 can have either two or four Elements, but half the Elements in any voice are *always* based on FM sounds, and half are *always* based on Advanced Wave Memory (sampled) sounds. This restriction is a little frustrating because it means that you can't stack three samples and one FM sound, or use four samples, within a single voice.

An Element consists of a sampled or FM sound, with its loudness envelope and LFO. Each LFO has speed, delay, and fade-in time parameters and five waveforms (including sample-and-hold), with separate amplitude and pitch modulation depths. There are seven aftertouch scales and eleven velocity scales to choose from, with such useful choices as "switch" and "offset ramp" available in positive and negative polarities.

Each Element has a flexible, 4-segment, volume envelope. The TG33 also sports preset envelopes, a time-saving feature that has appeared on more than a few synths lately. You can choose from six presets (piano, guitar, pluck, brass, strings, and organ) that set up the envelopes for you, and you can tweak them

from there. You also can call up the envelope settings that are preset for the sample or FM patch used by each Element. There are sixteen level-scaling curves and eight rate-scaling curves to choose from, so you can set up changes in level and envelope times based on keyboard position. There are even global attack and release adjustments that affect all of the Elements in a voice, a time-saver that I'd like to see on every synth capable of layering tones.

For the FM Elements, you can choose from a fairly good selection of 150 4-operator presets and 106 single-cycle waveforms, and you have control over modulator amount and feedback, giving you a lot of tonal flexibility. With a little tweaking of envelopes, feedback, and velocity scales, you can get a lot of variety out of the FM patches without wading through too many parameters.

You can choose from 128 AWM sounds, including 81 instrument samples, 38 single-cycle waves, eight chaotic wave sequences, and one (un-editable) drum kit. Some of the instrument samples (such as piano, acoustic guitar, and slap bass) are multisampled, and all but fifteen are looped. There's a good selection of representative instrument samples, including serviceable versions of all the basics. The real standouts are "Brass Attack" (a meaty and useful horn hit), the "Itopia" vocal sample (which sounds a lot like the Art of Noise's trademark "Oos"), and the looped "Water," "Mix," and "Styroll" samples (which can give your patches that bubbling quality you hear in a lot of Korg M1 patches).

The single-cycle instrument loops (such as "StringBody" and "AirBlown") are effective, especially when layered with other samples, although Yamaha's AWM waveforms don't sound as good as the 16-bit samples found on the E-mu and Korg instruments. If you listen to the samples dry, with the envelopes wide open and the effects bypassed, you'll hear some aliasing noise, hiss, and some pretty tight loops, but this is to be expected on an instrument in this price range. In the context of a finished patch, with reverb and dynamic Element-mixing going on, the grunge isn't much of a problem, and it can be a real plus when you're trying to create the ultimate "scary strings" preset. A lot of the most impressive patches I created on the TG33 used samples that were tuned to their lower limit; the aliasing noise made the lower pitches sound positively industrial, and with the built-in reverb going full blast, the TG33 sounded like it cost a lot more than it actually does.

GIMME A VECTOR

The mix between the two or four Elements in each TG33 voice is controlled by the joystick (not spring-loaded) on the front panel. Elements are assigned to points, labeled A/B/C/D, at twelve, six, three, and nine o'clock respectively. If you move the joystick to any of these positions, you'll hear only one Element; however, if you wiggle and sweep it back and forth, you should hear the mix between the Elements change.

The fun starts when it's time to record the movement of the joystick and create a set of Level Vectors. The TG33's approach to vector synthesis differs from those found in the Prophet VS and Korg Wavestation in that it actually records the movement of the joystick, in real time, as you play and hold a note. On the VS and Wavestation, you move the joystick to set five "points" and set the time it takes to fade from point to point. This procedure inevitably involves a lot of trial and error as you adjust a point, audition the sound, readjust the

point, audition the sound, etc.

The TG33 makes this process much easier. You simply set the Vector Rate (the time interval between "samples" of joystick position, which can be from 10 to 160 milliseconds in 10 ms increments), play a note, and move the joystick as the note sounds. If the TG33 stops recording the joystick before you finish moving it, you can make the vector rate a little longer and try again. (Since there are always 50 samples in a sequence of vectors, setting a longer interval between samples lets you record a longer joystick movement.) If you don't like the vector you've recorded, you can record another, or manually edit the one you have. For each of the 50 steps, you can adjust the X and Y levels (though, unfortunately, not with the joystick; you must use the data-entry increment keys), and you also can adjust each step's time value, which lets you make a step last anywhere from 1 to 254 times the vector rate. This is great, because you can record a short, jerky, vector sequence and stretch out portions of it to create smoother, more gradual tonal changes. You can truncate a vector sequence by selecting End for a step's time value (the sequence will not play past that point), and you can create looping vectors by selecting Repeat (at which step the sequence will loop to the beginning).

Besides recording level vectors that control the mix between the Elements, you can record and edit "Detune" vectors in exactly the same way. Although you won't want much detuning in most imitative patches, it can be quite useful in layered stacks consisting of two samples and two FM patches. The Detuning vectors let you create some delicate, chorus-type effects, but they only partially make up for the fact that the TG33 lacks a pitch envelope, and the range of detuning is fixed at what sounds like 50 cents (half of a semitone).

The other parameters common to all Elements in a voice include effects type, balance, send level, and pitch bend range. Four toggles enable or disable mod wheel and aftertouch control of LFO modulation, routed to amplitude and pitch. You can set the amount of aftertouch-controlled pitch bend, and toggle (on/off) aftertouch control of level, but these parameters would be much more useful if they were available separately for each Element, instead of at the global level.

The TG33's digital effects unit has sixteen presets, including a few multi-effects such as delay with reverb and distortion with reverb. The only controls you have in the effects department are effect type, wet/dry balance, and send level, but with five reverbs, three delays, doubler, ping-pong, early reflections, and gate reverb, you probably can find something that at least approximates what you need. The reverbs are dense, and the "panned early reflections" effect is great on any patch with a sharp attack. It may be hard to use the delay presets, however, as you have no control over delay time.

EDITING AND THE FRONT PANEL

The TG33's panel is fairly simple, with a 2-line, 32-character, backlit LCD display. The bank and program keys (eight of each) do double duty: When in edit mode, the first four bank keys access the voice common, voice vector, Element tone, and Element envelope sections. From there, you use the page and cursor increment (±) keys to navigate within each section. While editing, there's a select button and a mute button for each Element, an effects-bypass button, and a button that temporarily kills any vectors currently active and lets you set a static Element mix with the joystick. The effects-bypass and joystick-kill switches are wonderful, as are the Element-select/mute buttons; editing on the TG33 would be no fun without them. As it is, the editing procedure is relatively painless, with no more than twelve pages in any section and little graphic depictions of such parameters as aftertouch curves and velocity scales.

ARCHITECTURE AND MIDI IMPLEMENTATION

The TG33's multitimbral architecture is excellent. Its internal memory can store sixteen Multi setups. Within each Multi, you can choose sixteen patches, one for each MIDI channel, and you have control over each patch's level, detune, note-shift, and panning (which acts as an offset to the per-Element panning programmed within each patch).

Each patch within a Multi can be assigned to Output Group 1 or 2 (each group has its own stereo outputs on the back panel), and you can control the effects send level for each group separately, so you can have some patches dry and some with effects. You only can have one effects preset active within a Multi (individual effects programmed into each patch are ignored), so having two output groups and two sets of outputs is crucial.

The only hitch is that you have to

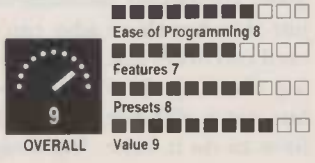
choose how many voices each group is going to be allotted, and when one group runs out of voices, it can't "steal" them from the other group. You can choose from 32 voices in Group 1 and none in Group 2, sixteen in each, or 24 in Group 1 and eight in Group 2. It would be great if you didn't have to decide on voice limits for the two groups, but this is forgivable on an instrument in this price range.

The only flaw in the TG33's voice architecture is that there is no way to assign two patches to the same MIDI channel. This would have made it possible to get huge timbres by layering complete patches, but Yamaha missed the boat.

Hard-core MIDI hacks will appreciate that every button on the TG33's panel can be accessed via Sysex commands, and the manual provides exhaustively complete data on doing bulk dump requests and parameter adjustments via MIDI. The joystick sends and receives data via continuous controllers 16 and 17, so you can record vectors on your sequencer, and a front panel LED flickers when any MIDI data is received.

Product Summary

PRODUCT:
TG33
TYPE:
Vector synthesizer
MAIN FEATURES:
16-part multitimbral operation; 32-voice polyphony; 2 to 4 digital oscillators per voice; 128 AWM waveforms; 150 4-operator FM presets and 106 single-cycle FM waveforms; vector-based, oscillator detuning and level-mixing; preset-only digital effects with 16 presets; two stereo, audio output pairs
PRICE:
$595
MANUFACTURER:
Yamaha (SGD)
6600 Orangethorpe Ave.
Buena Park, CA 90620
tel. (714) 522-9011



THE BOTTOM LINE

Anyone who's tried to program swelling, sweeping textures on synths equipped with mere envelope generators (instead of vector controls) will agree on one point: All synths should have vector controls. I'd love to see vector-type mixing available on every synth I own, as it provides an easy way to create lovely, sweeping timbres out of relatively ordinary-sounding Elements, and it can be used with great success to add subtlety to everyday sounds, such as pianos and basses.

Other than the inability to stack patches, there isn't a whole lot wrong with the TG33. The raw material for sound creation is quite good, and programming it is reasonably straightforward, if not a joy. Its unique desktop/rack-mount configuration (with multi-position rack ears included) offers a lot of mounting flexibility. At a suggested list price of $595, the TG33 is a great value for anyone looking for a synth module with something different.

Charles Clouser's *keyboard/drum programming can be heard on ABC TV's* Undercover *series and on his band's self-titled, major-label debut,* 9 Ways to Sunday.

Digidesign SampleCell

By Paul D. Lehrman

Digidesign redesigns a 16-bit sampler as a board for the Mac II and throws in a huge sample library to create an entirely different electronic musical instrument.

SampleCell is Digidesign's latest step in their quest to bring complete music and audio capability inside the Macintosh. There are a number of advantages to this approach, both economic and ergonomic. First off, it's less expensive to customize a mass-market computer than it is to design hardware from scratch. Also, the graphical interface and high-resolution screen of the Macintosh are far more suited to editing audio than the 2-line LCDs found on most samplers, or even the low-resolution video that the best models support.

Digidesign's Sound Accelerator card allowed the Mac user to edit samples and hear them in real time (although they still had to be off-loaded to a hardware sampler for effective performance). This evolved into Sound Tools (and the lower-cost Audiomedia), which turned the Mac into a stereo hard-disk digital recorder and editor. Along the way, there was also MacProteus, bringing the power of E-mu's ROM sample-player inside the computer.

SampleCell is the next logical step. Simply described, it is a 16-voice, 16-bit, RAM-based, sample-playing card for the Mac II. It has no recording capabilities onboard, but it does have extensive facilities for editing and modifying samples. You can use Digidesign's other products to create a complete sampling system. It also comes with a huge library of pre-formatted samples on a single CD-ROM.

Digidesign Sample Cell

GETTING IT IN

SampleCell is a NuBus card that fits into any Mac II. It is based around the chip used in the Dynacord ADS family of samplers (which, sadly, are no longer available in this country) and provides full, 16-bit fidelity at sample rates up to 48 kHz. It can play up to sixteen mono, or eight stereo, voices (in any combination), polyphonically and multitimbrally, with eight separate audio channels.

In real time, the Macintosh supplies only MIDI-level communications, so SampleCell puts almost no load on the computer. This means that multiple cards—as many as you have slots for—can be used simultaneously. Filling all six slots in a IIfx, for example, would give you 96 voices on 48 audio channels.

Installation is moderately involved. SampleCell plays its samples from onboard RAM; up to 8 MB of it. The card is available from Digidesign either empty or "pre-stuffed," the latter costing $1,000 more. In my book, you'd be nuts to buy a stuffed SampleCell because you can buy the SIMMs (identical to those used in the Mac) for less than $50 each, install them yourself, and save about $600. Digidesign recommends you do just this, but those who can't be bothered can order the stuffed card. Installing the chips is a delicate operation, but not a difficult one, and you only have to do it once. Digidesign is kind

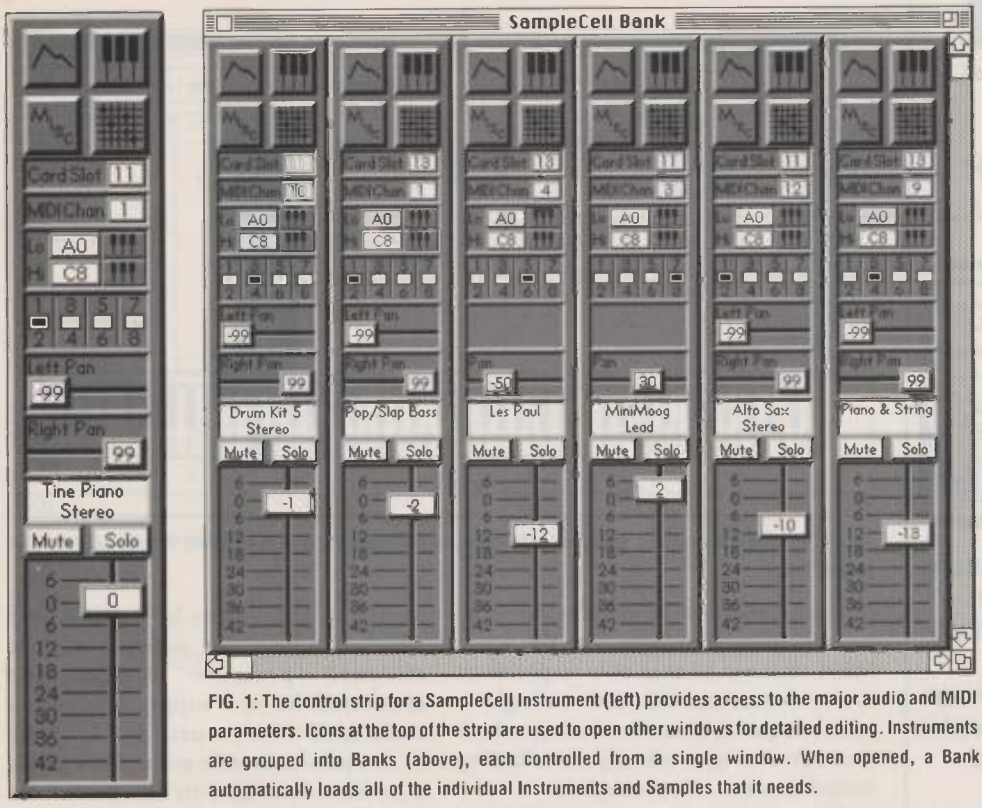


FIG. 1: The control strip for a SampleCell Instrument (left) provides access to the major audio and MIDI parameters. Icons at the top of the strip are used to open other windows for detailed editing. Instruments are grouped into Banks (above), each controlled from a single window. When opened, a Bank automatically loads all of the individual Instruments and Samples that it needs.

enough to provide a very clever tool for de-installing the SIMMs, should you have any problems.

After stuffing the card, insert it into an empty slot inside the Mac. The eight audio outputs, in the form of four stereo, ¼-inch jacks, are accessible through the knockout at the back of the computer. Two cables, each with a stereo ¼-inch jack on one end and two mono, ¼-inch jacks on the other, are provided.

Next, you have to prepare the computer. First, copy the *SampleCell Driver* into your system folder, then copy the *SampleCell Editor* application onto your hard disk (none of the software is copy-protected), along with Digidesign's sample-editing program, *Sound Designer II SC*. Then, copy the *MIDI Manager 2.0* files—the Apple *MIDI Driver*, and the *MIDI Manager* init—into your system folder. Finally, install the *Patch Bay* DA (with *Font/DA Mover* or *Suitcase*), or copy the *Patch Bay* application.

The sample library comes on a CD-ROM containing no fewer than 630 MB of samples. (A few samples also come on floppy, but they're really just a tease.) If you don't have a CD-ROM player, you'll need to get one to take advantage of the library (a "hidden" cost, but one that is well worthwhile). You'll also need to install the CD-ROM cdev into your system folder, and don't forget to watch out for those pesky SCSI ID conflicts.

STRUCTURE AND EDITING

SampleCell Editor is used to configure the SampleCell card. It is logical and Mac-like, and provides most of the features you'd expect from a top-of-the-line sampler. On booting, the program puts an empty bank, the highest level of the software's hierarchy, on the screen. A bank is a complete configuration of "instruments," up to sixteen for each card installed in the system, arranged to resemble fader modules on a mixer (see **Fig. 1**). Output level, output channel selection (one of the four stereo pairs), pan, mute, solo, MIDI Channel, and high and low note limits are set in each module. Several banks can be open at the same time, and although it's typical for a card to correspond to a single bank, a bank is able to address instruments on more than one card, and a card's instruments can also be controlled by more than one bank.

More elaborate editing functions are accessed by clicking icons in each module. A black-and-white keyboard icon opens the Sample Map window (**Fig. 2**). Here, samples are assigned across the keyboard for multisampling, and velocity-switching "zones" are set up. An instrument can have up to twenty keyboard regions, or "keygroups," and within each keygroup, up to three different samples can be velocity switched. There is no velocity cross-fading within an instrument. Adjusting velocity zones and keygroup ranges is done entirely graphically, and any one sample can be easily selected for editing or replacement without disturbing the others.

The samples themselves are not edited within the *Editor*. That is the job of *Sound Designer II SC*. It also lets you use sounds from external hardware samplers in SampleCell. You can easily have both programs running in *MultiFinder* (assuming there's enough memory in your Mac), but after a sample is edited in *Sound Designer*, it must be reloaded into the SampleCell card. This is an easy operation, but it can take a while if the sample is large. Stereo samples are supported and treated as single files.

There are some things that can be done to a sample in the SampleCell software, however, and these functions are accessed by double-clicking on an individual sample in the Map window. This opens a Sample Parameters dialog window, where you can tune the sample, as well as adjust its sustain and release loops, if it has any. You can alter the amplitude of the sample relative to the others in the instrument; the start point (for modifying attacks); the MIDI root note (for transposing the keyboard); and whether the sample plays forward or backward. You can also set an individual pan position for the sample, so that you can stretch multisamples across the keyboard and create stereo images out of maps containing mono samples.

In a Miscellaneous Functions window (**Fig. 3**), the instrument can be detuned (up to four octaves) in hundredths of a semitone, and parameters for voice retriggering and note priority are set up. MIDI volume and keyboard tracking are enabled and disabled (you can disable keyboard tracking for sound effects and drums), velocity curve and pitch bend range are set up, and a cross-fading function can be enabled. This last

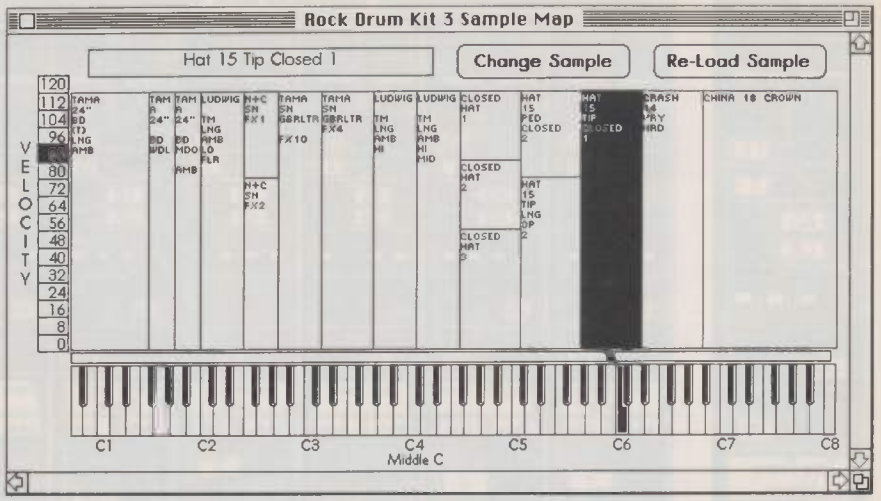


FIG. 2: The Sample Map window gives the details of sample assignment by pitch and velocity in an easily interpreted, graphic format.

function modifies the velocity curves of two instruments assigned to the same MIDI channel so that one responds at low velocities and the other at high. It is an adequate, if a trifle clumsy, substitute for the true velocity cross-fading found in some other samplers.

The window also provides two "auxiliary" outputs for the instrument, each with its own level control and switch for pre- or post-main fader operation. These outputs are normally used to add processing to the signal, and they can be dynamically controlled in software, so that the amount of signal sent to processing can be time-, volume-, or controller-dependent, opening up all sorts of expressive possibilities.

Another window shows three ADSR envelopes. The envelopes are adjusted graphically, and you can set an overall level for the envelope, a gate time (the minimum amount of time the sustain segment will sound, very useful for long drum samples), and whether the envelope will track the keyboard, i.e., get shorter as the note number goes up. Envelope 3 is "hard-wired" to the amplitude of the sample, and is normally used that way. The other two envelopes, however, are user-definable in the Matrix Modulation window,

MATRIX MODULATION

The Matrix Modulation window (Fig. 4) is arguably the most powerful section of the SampleCell software. It's a concept that many musicians (particularly Oberheim and Kurzweil users) will find familiar. Up to sixteen controller paths can be defined, each with a source and a destination, chosen from pop-up menus. A source can be a MIDI note number, note-on or note-off velocity, channel pressure (polyphonic aftertouch is not supported), pitch bend, mod wheel, sustain pedal, or one of two user-definable controllers (each instrument can have its own pair of definable controllers).

There is also a random-number generator; a ramp generator with adjustable time; two LFOs, each with selectable speed, amplitude, sync, and waveform; and the three envelopes. Plus, there is a "tracking generator," a user-definable transfer function consisting of four line segments, that can set up non-linear control slopes such as velocity or pressure curves that are not sensitive at low values but very sensitive at higher ones.

A matrix destination can be pitch, volume, panning, sample select (normally used with velocity to enable velocity-switching, but you can also use a controller, such as a footpedal, to determine which sample will sound the next time you hit a key), sample start point, the overall amplitude of any of the envelopes or the level of any segment, the speed or amplitude of either of the LFOs, or the level of one of the auxiliary sends.

Each modulation path can be scaled, either negatively or positively, so one source can be used to change one parameter one way and a different parameter in the opposite direction. This scheme gives the user tremendous flexibility, and the simple and direct way it is laid out on the screen makes it a snap to use.

The veteran sampler user will notice

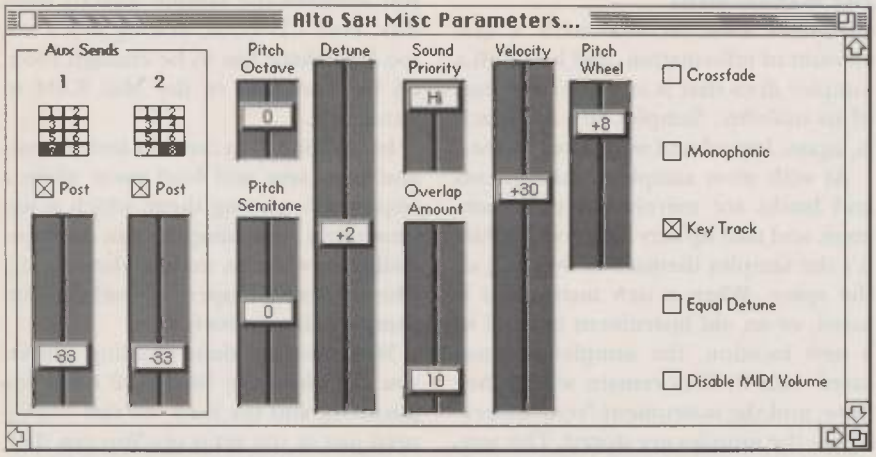


FIG. 3: The Misc Parameters window provides control over tuning and sensitivity to velocity and the pitch wheel. It also lets you use two of SampleCell's eight outputs as auxiliary effects sends.

an important omission from this list of destinations: filters. The Dynacord chip in SampleCell (as in the Dynacord samplers) does not allow dynamic filtering, which shows a major difference in philosophy between Dynacord and Roland, E-mu, Ensoniq, and Akai, for whom filtering is an important feature. Filtering can produce timbral changes based on note number, velocity, or other factors, and the proper use of filters can mean that fewer samples are needed to produce good-sounding samples over a wide dynamic and pitch range.

SampleCell's approach is the opposite: To get the best range, use lots of samples. It is not an absolutist position—you can, for example, change a sample's start time with velocity, a very effective way to relate attack time and timbre to loudness, and the envelope tracking is highly useful for extending pitch ranges—but it indicates that the unit is more oriented toward "realistic" sample playback, as opposed to the more creative, "synthetic" sound modification that samplers with filters can accomplish. I suppose it's a reasonable trade-off, but it's unfortunate that the only way to get a SampleCell to produce those ethereal filter-swept voices that come with the Roland S-770 sampler is to sample the S-770.

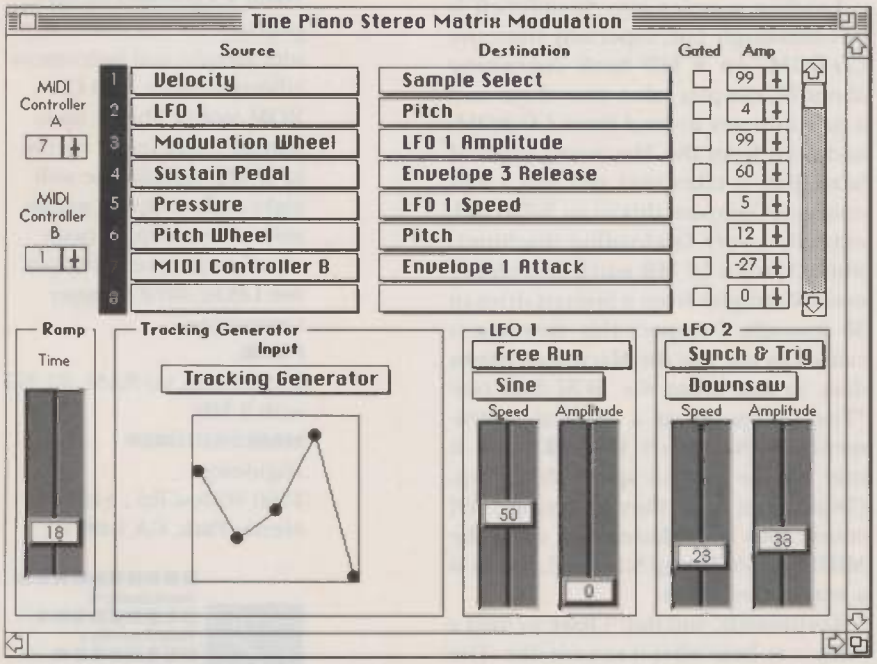


FIG. 4: In the Matrix Modulation window, up to eight internal and external control sources can be patched to modulate an Instrument's parameters.

● SAMPLECELL

FILE MANAGEMENT

Samplers have to deal with a vast amount of information, and how well a sampler does that is an important part of its usability. SampleCell's approach is, again, logical and well-thought-out.

As with most samplers, instruments and banks are merely sets of parameters, and take up very little room, while it's the samples themselves that hog all the space. When a new instrument is saved, or an old instrument is saved in a new location, the samples are not saved with it; they remain where they were, and the instrument "remembers" where the samples are stored. This way, samples don't have to be duplicated, either on disk or in SampleCell's RAM.

Similarly, a bank "remembers" the location of all of its constituent instruments, which are treated as separate documents. If you make changes in an instrument and then save the bank the instrument is part of, the software makes sure you save the new version of the instrument as well. There is a flaw in this scheme, however, that appears if the instrument was originally loaded from CD-ROM. If you try to save the bank after changing the instrument, you will get an error message explaining that you *can't* save the instrument because the disk is locked (CD-ROMs are, by definition, locked), and the entire operation will abort. Instead, the program should allow you to specify a different location for your new version.

Loading samples into SampleCell is not blindingly fast, especially from the CD-ROM. An 8 MB bank containing about 30 samples takes over three and a half minutes to load from CD-ROM, and even from the Macintosh internal hard disk, it takes over two and a half minutes. Compare this to an S-770 (admittedly a very fast-loading machine), which loads a 16 MB patch containing over 30 samples from a Syquest drive in 30 seconds. I suspect this slowness is caused by the way the Macintosh passes data to and from the SCSI bus (see "The Computer as a Musical Instrument" in the March 1991 EM), and it may not be easy to speed things up. (Digidesign says they're trying.) Of course, this is still faster than using the MIDI Sample Dump Standard, but so is a snail on sedatives.

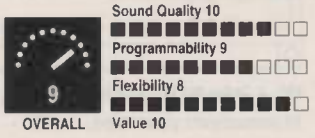
Fortunately, you don't have to load a sample to hear what it sounds like. The dialog box that appears when loading samples has a "Play" button that lets you audition the sample directly from disk, even CD-ROM, as long as it's not too big (there has to be enough room on the card *and* in the Mac RAM to handle it).

In addition, you can edit instruments and even save and load them while a sequence is playing them, which is not something most samplers can do, especially not while in multitimbral mode. This makes that aspect of working with SampleCell extremely fast.

When you are done creating a bank, you can close the *SampleCell Editor* application, and the card will stay configured just as you set it up. You can then use it as a MIDI instrument with a sequencer or any other application, and it will continue to perform until you turn the power off. If you want to make adjustments in the bank or the instruments, you can re-load the *Editor* program, and it will pick up just where you left off.

Product Summary

PRODUCT:
SampleCell
TYPE:
Sample Playback Card
HARDWARE REQUIREMENTS:
Macintosh II, hard disk, MIDI interface. CD-ROM player and Sound Tools or Audiomedia recommended
MAIN FEATURES:
16-bit RAM-based sample playback for Macintosh II, with sample- and instrument-editing software, and CD-ROM sample library; up to sixteen voices (eight stereo) at 48 kHz sample rate with eight audio outputs; sustain and release looping (with crossfade); three envelopes; two LFOs; *MIDI Manager* compatible
PRICE:
$1,995 with no RAM; $2,995 with 8 MB
MANUFACTURER:
Digidesign
1360 Willow Rd., #101
Menlo Park, CA 94025



RECORDING AND IMPORTING SAMPLES

To create your own samples for SampleCell, you need some other hardware. You can use a MIDI sampler, in which case the samples have to be transferred into the Mac, or you can use one of Digidesign's recording systems, Sound Tools or Audiomedia.

If you have Sound Tools, you already have all the functions you need to record, edit, and play back samples. If you have Audiomedia, however, you'll need *Sound Designer II SC*, because the Audiomedia software doesn't create loops. You record your samples in Audiomedia and immediately open them in *Sound Designer* for editing. (Both programs work directly with hard disk files, so no saving/loading or Clipboard-transporting is necessary.) If you're using an external sampler, *Sound Designer SC* will happily deal with MIDI, RS-422, or SCSI transfers.

You can also create files with *Turbosynth*, *Deck*, Opcode's *Studio Vision*, or Passport's *Alchemy*, and you can even use Macintosh *SND* resources. All of these files can be edited in *Sound Designer II SC*, which contains a driver for playing the edited sounds directly through the SampleCell card, without waiting for them to load.

LIBRARIES

If you are not inclined to record your own samples, the CD-ROM library that comes with the SampleCell package can keep you busy for a good long time. CD-ROM drives are now available for less than $500 and should be considered as a normal part of a SampleCell system. It's by far the most reasonable way to access large sample libraries.

There are some 617 instruments on the SampleCell disk, made up of over 2,000 samples (don't do a "Get Info" on the Samples folder on the disk, or you'll cripple your computer for half an hour), from orchestral winds and strings, to several grand pianos, electric guitars, ethnic percussion, and a set of *Star Wars/Robocop*-style sound effects. Most of them were created by Prosonus and are uniformly excellent in quality (but no, I didn't check all of them).

Be warned that some of the instruments are very big. Multimegabyte instruments abound, and one Bosendorfer grand piano takes up nearly 8 MB. If this is a ploy to get you to buy more SampleCell cards, it's pretty effective. Many of the instruments also are provided in "Lite" versions using fewer samples. They sound nearly as good, but still are not small. To those of us who used to load entire orchestras from floppy disks, it's remarkable to think that one could easily fill up 8 MB of RAM long before you're finished designing the sixteen instruments in a bank.

Digidesign concedes that portions of their library could be considered overkill and says that other libraries for SampleCell, due out soon from various third parties, will make more modest demands on memory. In the meantime, having an extensive library all ready when a new sampler is introduced is an excellent way to make sure people are able to put the sampler to good use right away, and makes for happy users.

PERFORMANCE

The audio performance of SampleCell is superb. I didn't do any formal testing, but I did record twenty seconds of a Telarc CD of a Beethoven piano concerto onto a hard disk using Sound Tools, and then loaded the file into SampleCell. When I triggered them both simultaneously and A/B-switched them in the monitors, I could hear no difference in dynamic range, noise, distortion, or stereo separation.

I did manage to find a few bugs in the software, none of them serious. Digidesign took them seriously, however, and as I reported them, they quickly sent out new versions to me with fixes. In one case, I got a new disk in about 15 hours, including the transcontinental flight. The documentation is quite good, although like most manuals, it could use more tutorial material, especially concerning the Matrix Modulation. Also, the index is rather skimpy, and there is a hilarious error on p. 6 of the Appendix.

Except for loading samples, the *Editor* program runs acceptably fast, although screen updates seem to take a long time. Running with *MIDI Manager* doesn't seem to hurt it, but when you're playing a sequencer, it slows things down a whole lot. If you're just playing sounds with SampleCell and external MIDI synths, it's not a problem, but if you're also using hard-disk audio from within *Studio Vision*, you could run into trouble, depending on what computer you're using. (*Digidesign recommends a Mac IIci or IIfx for applications that combine hard disk audio with MIDI.—GH*)

● SAMPLECELL

In trying to use SampleCell with *Studio Vision,* my results with a IIcx were less than satisfactory: There were constant disk errors when playing audio, and the program frequently stalled. Opcode has plans to introduce an alternative operating system to *MIDI Manager* that may well solve these problems, but it wasn't available for testing at press time. With a IIci or faster machine, I am told by reliable sources, performance with *Studio Vision* is fine.

Speaking of older, smaller machines, there is a lot of confusing information floating around about expansion chassis that will let you mount multiple SampleCell cards into a three-slot Mac. Apparently the only such device that works for sure is from a company called Second Wave (tel. [512] 343-9661). Some of the first SampleCell cards produced won't work with it, but Digidesign is offering an upgrade at a nominal fee.

WHO NEEDS THIS?

SampleCell is a fine product for a very exciting market. It sounds great, is a joy to program, and provides a lot of flexibility. Conceptually, it fits nicely between the ROM-only MacProteus and Digidesign's hard disk audio systems, and it will find itself equally at home in musical and post-production applications. For the latter, it makes perfect sense to supplement a 2-track hard disk system by "off-loading" one-shot or repeating sound effects into SampleCell, leaving the hard disk tracks free for dialog and acoustic music. Firing effects through MIDI gives infinitely more flexibility than loading them on 24-track tape.

SampleCell is certainly the most expandable, and the most integrated, sampler ever offered. Although there are samplers whose operating system can be considered to be in the same league, there aren't many of them, and they are very expensive. The beauty of having a large sampler inside a computer is that you have a common source of samples, on hard disk or CD-ROM, that can be easily managed and shared without shuffling floppies, disconnecting SCSI cables, and all the other silly things needed to use multiple samplers. The user interface is also a major plus in that the system becomes as fast and simple to use as any Macintosh application.

Should you buy SampleCell? Or, as many are asking, should you sell all your current samplers? It is tempting. If you already have a fast Mac II (and especially if you are already using Sound Tools), SampleCell, with its bundled library and *Sound Designer II SC,* is a bargain (even after you add the price of a CD-ROM player). If you don't need a zillion voices right away, you don't have to pay for them, yet the system is expandable more easily and cheaply than any conventional sampler.

Conceptually, SampleCell fits nicely between the ROM-only MacProteus and Digidesign's hard disk audio systems.

On the other hand, if you've already invested in a high-end sampler and you like it, have plenty of sounds for it, and have it well-integrated into your system, then SampleCell may not be for you. If you don't already own a Mac II, then the old sampler probably won't fetch enough to buy everything you need: Besides the computer, you've got to pay for a monitor, keyboard, hard disk, recording hardware, MIDI interface, and CD-ROM player. If you're willing to take the short-term loss, though, it might put you into a good position for expansion in the future.

Finally, if what you really want is a multi-megabyte sampler with potentially dozens of discrete outputs, integrated with a hard-disk digital audio system and running from a single, graphics-oriented front end, you simply have no choice other than SampleCell unless you're prepared to spend about ten times as much money on something like a Synclavier. And the more-expensive system won't fit on the back seat of your car.

Paul D. Lehrman *has been waiting for music technology to come up to his expectations and down to his budget for many, many years. He thinks it just may be getting close.*

(continued from p. 44)

GETTING WIRED

Cable the sound system from back to front; that is, run speaker cables first, then returns from the snake to the amps. When cabling the stage, there are two objectives: Keep it neat and unobtrusive, and keep audio cables away from AC or MIDI cables. Bundling helps avoid the latter problem immensely. Cables that need to run across stage should be taped down to avoid tripping performers. Anything taped down should be taken up at the end of the night—or earlier, if there is a problem—so avoid going overboard on tape. Any slack in cables should be coiled neatly and left in the most logical place. With microphones, this is at the base of the mic stand, since it may be necessary to move the mic stand for some reason. For a keyboard rig, coil the slack at the instrument amplifier or direct box (if it feeds the snake).

Cabling also is a major concern at the mixing station. With all the wires coming in and out of the console, things become a rat's nest unless cables are run logically and neatened when patching is done. Make sure the snake is protected in the stretch from the wall to the mixing station. Cable bridges, or long rubber runners (like those used to protect carpeting in hallways) can be a great way to protect the snake from damage and simultaneously minimize the chances of an audience member stumbling over it. Failing that, good old duct tape can be used, but it does little to prevent snake damage.

After finishing setup, and before powering the system, make sure none of the AC circuits are overloaded. If you have more than one large power amplifier on a single circuit, you may run into problems late in the gig, when things are really rocking hard. Apply one or two pieces of tape to keep the AC cables from being inadvertently kicked out of the outlets, but remember that you might need to unplug them quickly in the event of a problem, so again, don't overdo it.

POWER UP

Now you can power everything up, but keep the volume down for the moment. Power amplifiers always should be the last things powered up and the first powered down to spare your speakers

and ears from pops that other equipment may make when powered up. Take a VOM and check for voltage between any combination of electric instruments and microphones (instrument-to-instrument, as well as instrument-to-mic). If you find more than a few volts, you have a problem that needs resolving before anyone takes the stage.

Sometimes it is necessary, or desirable, to start soundcheck without making a lot of noise. Inputs to the mixing console often can be checked with meters and/or headphones, without turning up the system amplifiers at all. With all inputs checked, bring up the amplifiers slowly and begin to test the house. Unfortunately, there usually is no substitute for ringing out a system; that is, raising the gain gingerly until the system is on the verge of feedback, finding the offending frequency, and equalizing it out.

The variety of problems that arise and solutions for them are legion, but there are some basic principles of troubleshooting that can be applied in any case. Understand that troubleshooting is a problem-solving exercise, with the objective being first to isolate, then conquer the problem. There are several ways to achieve this. One is the scientific method: Hypothesize a possible source of the problem and devise a test to prove or disprove the hypothesis, then proceed based on the results. Next, the process of elimination: Strip the signal path down to a skeleton and, assuming that works, add things one at a time until the problem returns, thus incriminating the last thing you hooked in. The third and least desirable is the empirical method, trial and error. Although the latter is the least logical approach, a performance situation places severe limitations on time and resources for troubleshooting, and some problems only yield to trying every trick in the book and seeing what works.

AFTER THE GIG

The crowd loved it and you got a bonus for your hard work and professionalism. Now it's time to pack up and go home. As soon as the performance ends, turn the amplifiers down and then off. Now you can power down anything else in the sound system. Next, put away instruments that might get damaged or stolen. After that, teardown is roughly the reverse of setup. Coil all cables carefully and put them neatly in the proper cases, or else you'll have to repack that case every time you do a gig. Don't forget to use your checklists and make a last check of the venue to be sure nothing is left.

Once everything is back home, it's time to kick out the jams and party, or go maintain a horizontal position for awhile, depending on your inclination. You even can review your tape recording of the evening's festivities (which you recorded after reading "Recording Live, On Location" on p. 46). And tomorrow, you'll be ready for the next gig. For as Robbie Robertson says in the song "Stage Fright," "When he gets to the end, he wants to start all over again."

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Musical Objectivity

Due to a lack of individual objectivity, much of today's electronic music produced on computers and sequencers is just plain boring.

By Mel Lambert

Like you, I spend a great deal of time listening to music. (In my case, I use music to evaluate the quality of recording, editing, or audio production systems and determine whether they exhibit the technical features and functions required by professional users.) While I would never claim to be a composer, I wonder what runs through the minds of a growing number of electronic musicians. I find too much of the material produced by today's emergent synthesists unreservedly boring.

I'm convinced they think otherwise. But look at the facts: All too often, the material has little sense of itself. A piece will be cluttered with odds and ends of musical statements, but without a central structure or clear focus. To my ears, a great composition is obvious from the first listening. It has a clear reason for being, a rationale for communicating a series of musical ideas.

My first suggestion to those who want to create better electronic music is that you accurately define the viewpoint of your musical efforts. You need to clearly separate self-discovery from objective communication, yet recognize their complementary natures. To accomplish this, bring a sense of discipline to your creative process. Instead of relying on the practically infinite palette of options available with computer-based compositions, start with small and tightly contained ideas, emphasizing structure, before you begin the inevitable process of embellishment.

Next, consider the proposition that creative sound design and music production are cooperative efforts. The one drawback with working in a home or project studio is that you often lack a regular stream of opinion. Working alone may help concentrate your attention, but it all too easily can lead to musical myopia. Share your ideas with as many kindred spirits as you can. In addition to seeking creative feedback, if you have commercial ambitions (a CD/cassette release, audio/visuals, video/broadcast post-production, film scoring, etc.), you need to be aware of current standards and musical expectations. Establishing a reputation in the industry often allows a composer to stray "outside of the lines," so to speak. The majority of us, however, will be judged against a Western musical tradition.

Third, you can avoid older musical cliches and the highly structured drum-machine syndrome. Having first laid finger to keyboard, keypad, or mouse, avoid using step-time programming during the initial stages. Although sub-second precision occasionally is necessary to emphasize a musical statement, most of us appreciate looser timing and a more "human" feel to the music's execution.

In essence, all musicians should be playing their chosen instrument, rather than simply programming it. The various data entry, editing, and refinement stages are undeniably important to the overall process. But, seen within the spectrum of events that contribute to the finished song or piece, they are simply mechanical stages. I suggest adopting a holistic technique. Play as much as possible in real-time to capture a stronger sense of cohesion and maintain continuity throughout the piece. The electronic functions available from MIDI-based sequencers and editors are a means to an end, rather than an end in themselves.

Finally, avoid the cliches of standard factory sounds and patches. We all have fond memories of our first experience with the trusty DX7, for example, but that's a poor reason to use those familiar textures over and over again. Ideas start in our imagination; giving flesh to them means selecting an appropriate voice with which to communicate your ideas. (I'm not saying that factory sounds have no place in your work, simply that to restrict the subtlety of sonic "colors" in your palette is counterproductive.)

It is often said that a professional in any line of business uses less to achieve more. How we communicate our inner viewpoint becomes far more important than what we use to realize a musical composition. Familiar tools—including computers, synths, and sequencers—add to a growing palette from which we can draw. Too much music springing from the fertile imaginations of new, as well as established, electronic musicians overlooks this unmistakable truth. In this era of enlightenment, that is unforgivable.

Mel Lambert *is actively involved with professional audio on both sides of the Atlantic and for many years served as editor of* Recording Engineer/Producer. *He now runs Media&Marketing, a high-tech consulting service for the pro-audio industry.*

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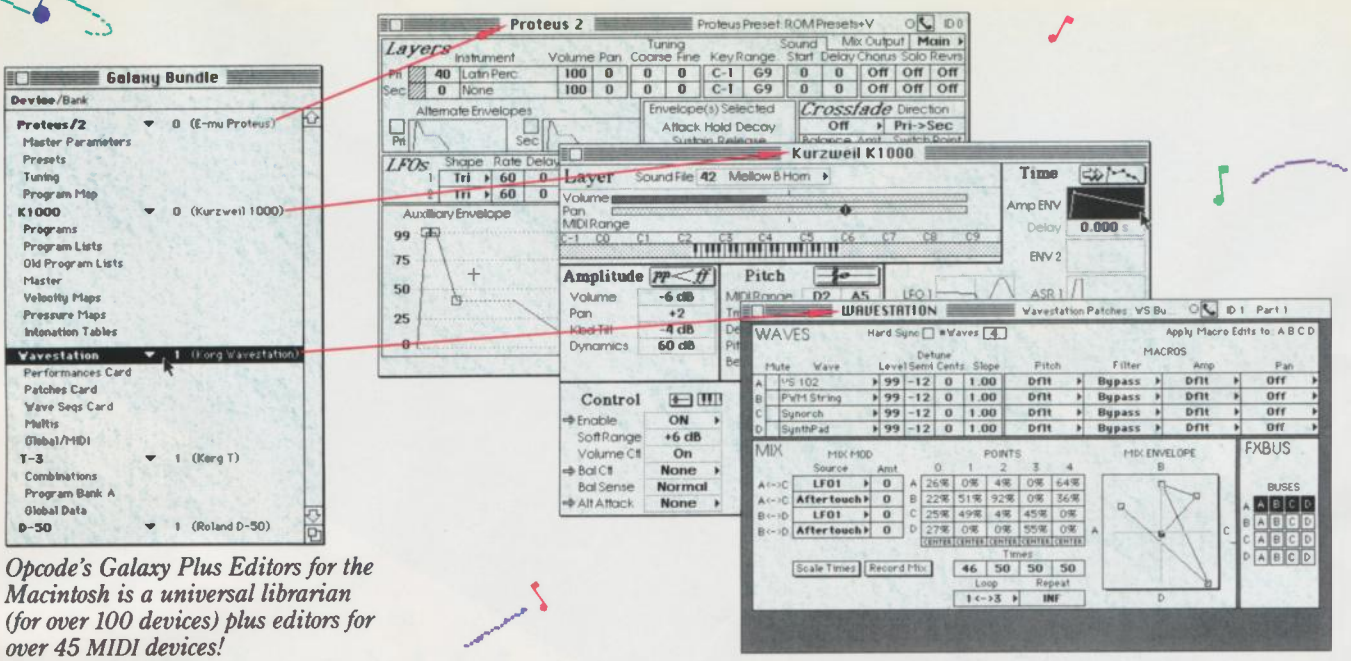

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