First Look at Roland's Hot New R-8 Drum Machine ■ IBM/MPU-401 Programming Tips

Electronic Musician

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May 1989

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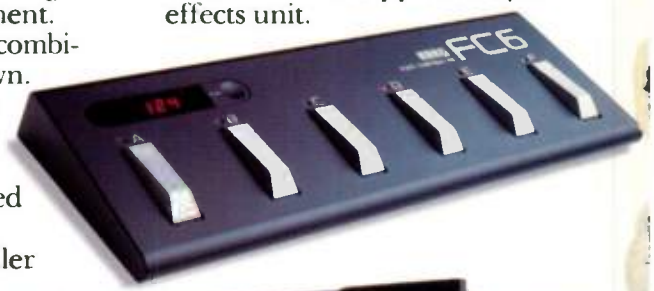

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Rack up today's hottest sounds with the Korg M1R.

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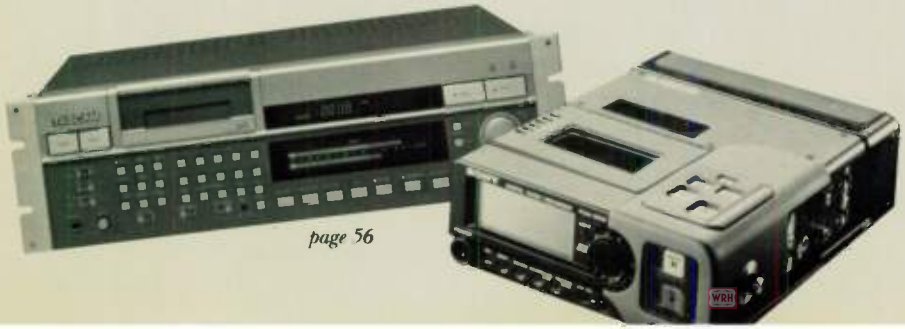

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Cover: Photo by David Bishop

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WHAT'S THE BIG IDEA?

SMALL.

OK, so the new Kawai PH50 looks small. But it sounds *enormous.* The PH50 contains 200 hot digital sounds from Kawai's legendary K1 that you can play as they are or layer, split, slice or dice in 50 combinations, plus MIDI, a built-in drum machine, battery operation and speakers that make it as comfortable on the beach or tour bus as on stage.

We think the go-anywhere play-anything PH50 has the highest "Gotta-Have-It" potential of any keyboard on the market. Just play it and see. And then when you find out the PH50's miniscule price, you'll agree that small is beautiful.

KAWAI
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FOR YOUR INFORMATION

WHAT'S NEW THIS MONTH:

Astute readers will notice that this issue does not contain the follow-up to Thomas Henry's MIDI computer project (Part One was presented in April). It turned out the thing was a lot more flexible than we realized at first, which necessitated including some additional information on applications. Hang in there; the next two parts are excellent!

ABOUT EM (*Electronic Musician*):

Since its inception in 1975 under the name *Polyphony*, EM has been a communications medium for sharing ideas, circuits, tips, and other information, and is dedicated to improving the state of the musical art.

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Occasional errors are unavoidable. We list known errors in "Letters." We compile published corrections annually for those who order back issues; to receive a copy, send a SASE to "Error Log Listing" at our Emeryville, CA, address.

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If you do not know basic electronic construction techniques, get a good book on the subject from your local electronics supply store (or try *Electronic Projects for Musicians*, available from EM Bookshelf). EM specifies parts values following international protocol, thus minimizing the use of decimal points and zeroes. A nanofarad (nF) = 1,000 pF or 0.001 µF. Suffixes replace decimal points. Examples: 2.2kΩ (U.S. nomenclature) = 2k2 (Intl. nomenclature). 4.7 µF (U.S.) = 4µ7 (Intl). 0.0056 µF (U.S.) = 5n6 (Intl).

If you detect an error in a schematic or listing, *let us know*. If a project doesn't work for you, contact us to see if anyone has reported any errors (wait at least a month for EM to be in circulation).

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It won't hurt your feelings.

This, in a nutshell, is the problem: As rhythm machines have become increasingly more consistent, they've also become increasingly less "human." What you put in has feelings. What it puts out doesn't.

Which is why we're taking this opportunity to tell you about our remarkable new R-8 Human Rhythm Composer, so named because it makes the drumming as natural as you had intended.

The R-8 doesn't simply move beats around or "sloppy up" the groove. To the contrary, it gives you such incredible control that you can shift the timing in increments as small as 1/384 notes.

Even the drumsticks are more human.

You can also program pitch, velocity, decay and nuance to such an extent that you'll actually be able to hear the drumstick move from the edge of the ride cymbal over to the cup.

And you can do all of this in either a predetermined way, in which case you use the "Groove" mode. Or in an unexpected way, in which you use the "Random" mode. (Just because we call it "random" doesn't mean you take what it gives. Once again, you can control everything.)

Nor does the "human" touch end here. We've also made the 16 pads velocity- and pressure-sensitive, so that the sounds end up feeling vibrant instead of clinical.

The Roland R-8 has eight patches where these "Human Feel" settings can be stored, and each of these patches functions as an "overlay" for any of the patterns in the R-8.

Of course, all of this wizardry would be lost if the sound quality wasn't what it should be. It is. The R-8 features 16-bit drum and percussion sounds sampled at a CD-quality 44.1 kHz. And even better, both the eight individual outputs as well as the stereo outputs are available for routing those CD-quality sounds to a mixer for individual processing.

Approximately 2,600 notes, or 10 songs, can be stored in the R-8's internal memory. And up to 100 patterns with up to 99 measures each, can be programmed in the unit. The R-8 has 68 internal sounds. And when you combine these with the two ROM/RAM cards, each of which contains 26 sounds, you have a total of 120 different drum and percussion sounds.

One more thing. If you record a particular pattern on an R-8, you can always go in after it's been recorded and assign panning, tuning, nuance and volume for each instrument for every single event in the pattern. The result can be something totally different than you'd expect from a drum machine.

As you've gathered, our Human Rhythm Composer is a truly remarkable and essential piece of equipment. Or as *Keyboard Magazine* put it, "If you're serious about making electronic music with the depth and expressiveness that used to require real live musicians, you owe it to yourself to get a demo of the R-8."

Our sentiments exactly.

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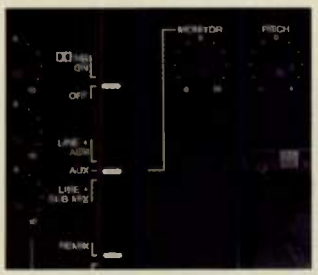
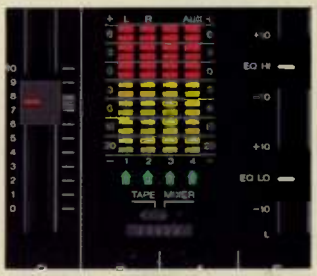
- Stereo Effects Receive.
- Tape Sync Capability for MIDI.
- Combine 11 Sound Sources in a Stereo Mix.
- Less than $450.00 Suggested Retail.

Sub-Mix Section. The X-26 sub-mix section allows you to adjust pan and gain for either tape or source on each of four channels. You'll find many uses for this 4 x 2 sub-mixer, which is very useful for overdubbing.

Mixing Flexibility. Six inputs, Master *and* Monitor Stereo Outputs, Stereo Effects Receive and Tape Sync Out give you plenty of mixing flexibility. Stereo Effects return is an especially nice feature for all mixing applications.



Monitoring Flexibility. With the X-26, you can monitor the main stereo buss, the aux buss (effects send) and the sub-mix buss. You can monitor the logical combinations, too.



Metering Flexibility. The X-26 allows you to switch the 4 meters between Tape (Tracks 1-4) and Mixer (Stereo L + R and AUX Send). You'll be able to see everything from input to output. What's more, multi-color LEDs also indicate tape mode and recording status.

X-26

The Newest Multitracker in the Finest Tradition.

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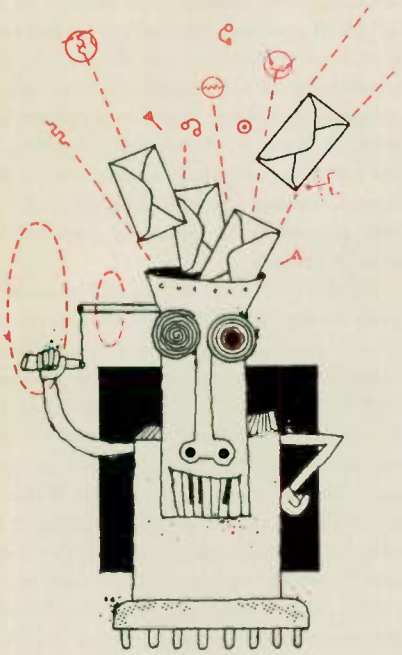
An Atari enthusiast reactivates core wars, and a recording aficionado goes in search of inexpensive digital multitracking.



REAL MEN DON'T USE 1 MEG MACHINES

I am disappointed with your recent articles on "The ST Power User." The new generation of Atari Mega computers and the Atari laser printer are today's power tools; the 1 meg workstation he described is a fairly standard configuration. Frankly, the software coverage was poor—just some dated public domain utilities and misleading hearsay.

Here are some of the more important errors of fact and omission. First, Atari was never in a patent infringement case regarding the GEM interface. That was between Apple and Digital Research, and resulted in an inferior GEM desktop for IBM computers. The ST version was not changed. Second, the blanket comment that all Mac programs are written the same is a joke (from personal experience with a Mac SE and Mac II). For any computer platform, some programmers will adhere to guidelines and others will deviate (often for valid reasons, not just lazy programming as Johnson postulates). His comments on hard disk file-fragmentation are specious. All hard drives experience fragmentation and need a "tune up" from time to time. By his admission, he never checked for the problem and is just repeating rumors. I use *Tune Up!* for my ST and *Symantec Utilities* for my Mac SE; I've never heard any confirmed reports of hard drive problems stemming from their use for defragmentation. Other irresponsible comments grossly exaggerated incompatibilities between applications and desk accessories. The six-desk accessory limit cited is a dead issue, thanks to the *MultiDesk* accessory.

A more accurate sketch of today's power user starts with a Mega 4 computer (4 megs of RAM); upgraded operating system with blitter chip for high-speed screen draws; internal, double-sided, 3.5-inch floppy drive; color/monochrome monitors; hard drive; and 2400-baud modem. For printing, dot matrix is fine for draft work, with the Atari laser printer for final copy. And of course, the ST/Mega line was designed with built-in ports for MIDI applications.

Regarding software, there are many superior programs developed expressly for the ST. Not only is Mac and PC emulation available, but ST users can run most Mac software faster than a Mac SE and a whole lot cheaper. The *Translator One* disk drive interface even lets you read/write Mac-formatted disks. As the IBM and ST share a common disk format, you can directly read/write text and data files (e.g., *Lotus 1-2-3*). Most IBM applications can be run using the *pc-ditto* emulator program. These inter-computer transfer capabilities let the ST work well with a Mac or IBM, or as a bridge between them. (*Of course, many other computers also provide for IBM compatibility.—Ed.*)

But what about MIDI programs on the ST? (*The writer then talks about a bunch of programs that had been covered in either our ST feature article (April '88) or in reviews, which is why Jim Johnson felt no need to repeat that information in his article.—Ed.*) Beyond sequencing, there are programs that support virtually all MIDI applications.

The entire tone of Johnson's articles was one of Mac envy. My point here is not to fuel a "computer war"; I happen to like the Mac and use one along with my Mega 4 system. Both have their particular strengths and weaknesses. What I, and many others, have found is that the ST/Mega computers are particularly effective for music and MIDI applications. While I welcome your all-too-infrequent articles on Atari computing and recognize you must cover several computer systems, inaccurate and outdated reports like these are unfair to your readers.

Jim Pierson-Perry
Maryland

Jim—A power user is a person who gets the absolute most out of a given piece of gear; we're not just talking about someone with a fat bank account and a laser printer. Any piece of equipment is a candidate for power usage. To say you must have top-of-the-line equipment to be a "power user" discounts getting the most out of, say, a C-64, or souping up a Volkswagen. Regarding our "infrequent" coverage of the ST, we average at least one ST-related article a month. Let's let Jim Johnson, the article's author, respond further:

"It's surprising you would find so much in my article to disagree with, Jim. My intent was not to cover everything there is to know about a power ST system, but to give those ST users who are not aware of its many non-music capabilities an idea of what their systems can do. The tone may have appeared a bit Mac-envious, but that was not my intent. I originally referred to that computer throughout as the 'Kumquat,' tongue-in-cheek, to mitigate some of my negative comments on the ST. However, the editors thought that using pseudonyms was probably insulting the intel-

ILLUSTRATION BY DAVID POVILAITIS

ligence of the readership, since it was obvious which computer I was talking about. This may have had the effect of making the tone more serious, as opposed to the irreverent, 'C'mon, guys, I've heard enough about those other computers,' tone I felt I had conveyed in the original draft.

"I did not mention MIDI applications because any **EM** *(or* STart*) reader can pick up any issue of either magazine and read several advertisements, reviews, and discussions of ST MIDI software. Information on business and other applications is likewise readily available in the ST press.* **EM** *also has conflict-of-interest guidelines; since I write commercial music software, I concentrated on non-musical utilities, particularly because one of the biggest surprises I've had as an ST user has been discovering the wealth of good public-domain utilities.*

*"*MultiDesk *was not available when I wrote the article, and I plan to discuss it in an update. I had been warned to stay away from* Tune Up! *by someone who had had problems with it, and* FSREPACK *(a public domain disk defragmentor that I tried to use) trashed one partition of my hard disk, so I was not about to recommend either program. I would expect* Tune Up! *to be pretty well debugged by now, as your experience suggests. However, disk fragmentation is indeed more serious on the ST than on other machines, for precisely the reason I mentioned in the article: the FAT search routine is very slow. Atari has recognized and corrected this in their new TOS 1.4 ROMs, which were not available, even in beta versions, at the time of the article. (These ROMs also correct the 40-folder bug and several other problems I discussed in the power user articles.)*

"Neither PC nor Mac emulation has the one capability that MIDI musicians would hope to see: some form of MIDI hardware-compatibility. In fact, the Mac emulator Magic Sac *requires the ST's MIDI ports for serial data transfer, so I doubt that many MIDI musicians would gain much by going by either route.*

"My comments on programmer's laziness should not be taken to refer to more than a handful of ST programs. I am one of those programmers who ignores the ST's 'guidelines,' such as they are, when there is a good reason to do so. But I've seen ST programs that need a 'command shell' to work properly (yet don't say so in the documentation) or put up menus that require you to 'press a key from 1 to 5,' or can't save to the hard disk because they don't use the ST's built-in file selector. While these programs do not reflect the quality of most ST programs, they can exist only because ST programmers are operating under

TEAMING TALENT AND TECHNOLOGY

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Originally developed for the Atari ST and Mega computers, this system provides the tools you need to increase and support your creativity. The individual modules within the system have been designed to allow you, as the musician, the flexibility to develop and enhance your musical ideas...at your own pace...regardless of your technical playing abilities. Total Control is easy enough for the novice and fully capable for the professional. When you compare the price to performance ratio for this system, it stacks as a valuable investment with great returns.

Here is an example of how Total Control works:

LUDWIG

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EditTrack - or - SMPTE Track

The original song developed in Ludwig can then be manipulated in either EditTrack or SMPTE Track...full feature sequencer programs. In either of these, your new composition can be quantized, transposed, rearranged and even radically altered. The editing functions of these sequencers are far more versatile and accurate than many other MIDI programs.

EZ-Score Plus

Now lets transfer your sequence to EZ Score Plus. With excellent music notation capabilities, EZ Score Plus will automatically translate your composition to music notation and allow you to print a professional copy of your song score for other musicians, publishers and members of the band.

Now, what about control of MIDI synthesizers and signal processors used throughout the song's arrangement?

Enter GenPatch...the universal patch librarian which will allow you to transfer "banks" of sounds or individual patches (programs) to and from all of your MIDI devices. The first advantage this offers is that you can build and access a library consisting of thousands of different sounds and load them into your instruments quickly. This saves you having to learn how to program each of your MIDI instruments.

Let's go a step farther:

Enter GenEdit...the universal patch librarian/editor. Iit gives you the capability to use your own original sounds rather than presets. The bigger the MIDI studio, the more essential GenEdit is for you. It replaces the need for individual patch editors for each synthesizer. You can design your own edit window which will control all of your MIDI devices in the same way rather than trying to control each device individually. GenEdit saves valuable time by storing, organizing and editing program/patch data for any MIDI device presently available...*or likely to be made available.*

Additional modules for the Total Control package are being developed.

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EZ Score Plus™ Music Notation Program

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A funny thing happens when technology advances. It forces musicians to think more and more like technicians. And less and less like artists.

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You can add expression to these sounds with our exclusive Poly-Key™ pressure and Patch Selects.

The rack-mounted EPS-M features

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SAMPLING. 16 bit stereo or mono multi-sampling (up to 32 seconds) with pitch shift, adjustable attack and decay, flexible output mixing, up to 12 simultaneous voices, support for MIDI sample dumps, triggering by audio input, MIDI or foot pedals.

MIDI. Program changes, freely mappable parameter changes, total automation in conjunction with sequencers, real time changes of programs and parameters *without glitching or muting*, preset register storage and retrieval.

EFFECTS. Seven split programs, many allowing chained or split operation, 40 bit internal DSP processing for high accuracy and low noise, input level or foot pedal can control any effect parameter, Multi Effects Chain with eight simultaneous effects, stereo processing, chorusing, auto panning.

. . . AND ONE MORE THING. THE ADR 68K IS ALSO A WORLD CLASS REVERB! With smooth, natural reverb programs, easy to use factory presets, more than 40 adjustable parameters, integrated sampling, and versatile reverb gates.

SYSTEM. People-sized remote with six faders, a large 160 character LCD for easy operation, over 10,000 words of built-in context sensitive help, upgradeable software. And more. And more. And. . . well, we've made our point. The ADR 68K sounds like it does a lot, because it does and it sounds great doing it.

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fewer restrictions than, ah, 'Kumquat' programmers.

"Regarding your 'more accurate sketch of today's power user,' perhaps this is true in the studios of L.A. or New York, but not out here in the trenches. A typical power user probably has a 520 ST beefed up to 2.5 megs, several (separate) floppy drives, and 20 to 40 megs of hard drive storage. I was trying to reach the substantial number of 1040 owners who didn't know what they could add to their present systems. Lord knows, I would never *discourage someone from buying a Mega 4, but we can't all afford them."*

DIGITAL MULTITRACKING FOR CHEAP?

Reading Rick Lathrop's Toshiba DX900 VHS VCR review, I wondered if this unit can be used, like a Sony F1, with two VCRs to dub back and forth for multiple tracks. Apparently this lets you dub many times without added noise.

My concern is that the DX900 includes no digital inputs or outputs. I know you can copy to another VCR, but can you play back to the DX900 instead? I assume you would need two DX900s to accomplish this task, but would the multiple A/D-D/A conversion stages add a lot of noise or distortion to the final tape?

Steven Genger
Illinois

The author replies: "The September '85 EM *has an excellent article on using a Sony F1 PCM adapter and two VCRs to create digital sound-on-sound recordings. The article states, 'The PCM-F1 is actually two independent adapters in one; while one section is encoding, the other section can be decoding a separate signal independently. Each section can accommodate a stereo pair of signals, thus allowing for true stereo sound-on-sound overdubbing.'*

"As I understand it, the F1 converts the digital PCM signal back to analog each time one of these encode/decode, sound-on-sound dubs is made. The DX900 uses the same PCM-to-analog conversion process and yields similar (excellent) sound quality. However, the DX900 will not encode and decode at the same time. Therefore, you would need two DX900s for sound-on-sound recording.

"The analog inputs/outputs of the DX900's PCM section are very clean indeed, so using two DX900s would be an excellent setup. The amount of noise added while making a sound-on-sound dub would depend, essentially, on your mixing board.

"The factor that makes the biggest difference in this kind of evaluation is price. PCM encoders with digital I/O currently go for about $1,300 plus shipping; a PCM encoder without digital I/O costs between $900-$1,000. A top-quality VCR adds at least another $400. So, a PCM adapter with digital I/Os and VCR would total about $1,700, nearly $1,000 more than the DX900. For sound-on-sound, two DX900s are still less than a PCM encoder and two VCRs." (Note: Toshiba has discontinued the DX900, but it is still available from some dealers. If you'd like to get your hands on one, I recommend you not wait too long.—Ed.)

CALENDAR OF EVENTS

May 14-17: Audio Engineering Society International Conference on Digital Audio, in Toronto, Canada. Contact: AES, 60 East 42nd Street, New York, NY 10165; tel. (212) 661-8528.

June 3-6: 1989 International Summer Consumer Electronics Show™ in Chicago, IL. Contact: 1722 Eye Street NW, Suite 200, Washington, D.C. 20006; tel. (202) 457-8700.

June: The Aruba Jazz & Latin Music Festival will be held the first two weeks in June, with concerts by David Sanborn, Ruben Blades, Jonathan Butler, Bob James, Lee Ritenour, Wilfrido Vargas, Johnny Pacheco, Celia Cruz, Wynton Marsalis, Dianne Reeves, Diane Schuur, George Benson, Najee, Jose Feliciano, and Wilkins. For specific dates and more information contact: Lou Hammond & Associates, Inc., 39 East 51st Street, New York, NY 10022; tel. (212) 308-8880.

June 27-29: Audio Engineering Society regional convention in Tokyo, Japan. Contact: AES (address above).

Please send all calendar items to our national business office *at least* three months prior to event.

ERROR LOG

In Alan Campbell's review of the Casio PG-380 MIDI Guitar Synth (February '89 issue), it was stated that the PG-380 delivers subtractive synthesis. This is not, in fact, the case.

The photos in "Breath Controlled 'Expressor'" (January '89) and "Not Just Another Headphone Amp" (March '89) were by Bill Kinneman. ■

1989 WINTER NAMM'S GREATEST HITS

The mood was upbeat, the products plentiful, and the prices right. If this show is a harbinger of things to come, musicians are in for some real treats.

By the EM Staff

Yamaha TQ5 sound module/sequencer

Last month's report covering the Winter 1989 National Association of Music Merchants (NAMM) convention discussed general trends. This month's report includes capsule descriptions of some of the hottest products at the show. Unfortunately, we ran out of space before we could cover everything of interest, but that's life in the publishing biz. Stay tuned to the "What's New" column for more information about upcoming products.

Not all the products mentioned below are currently shipping. Some are prototypes and may never see the light of day or will be substantially modified before they hit the stores. Prices, specifications, availability, color schemes, companies, names, and just about everything else is subject to change without notice. For more information, call or write the manufacturers and mention this issue of **EM**.

Akai (PO Box 2344, Fort Worth, TX 76113; tel. [817] 336-5114). *XE8* ($899.95): 1U rack-mount, 16-bit, sampled-drum, expander module includes sixteen different, editable drum/percussion sounds in ROM and card slots for adding more sounds.

Alesis (3630 Holdrege Ave., Los Angeles, CA 90016; tel. [213] 467-8000). *1622 Mixer* ($799): sixteen channels (with eight XLR mic inputs), six sends, four stereo receives, inserts on all channels (including buses and masters). *HR-16B* ($499): alternate HR-16 drum machine with more stylized, aggressive sounds. *MEQ-230* ($199): 1U rack-mount, dual, 30-band (⅓-octave), graphic equalizer.

Anatek (400 Brooksbank Ave., North Vancouver, BC, Canada V7J 1G9; tel. [604] 980-6850). *Pocket Merge* ($99.99): merges two MIDI signals. *Pocket Pedal* ($99.99): translates the motion of any standard volume pedal to MIDI continuous controller data, or utilizes momentary footswitch to control sustain, sostenuto, MIDI start/stop, and portamento on/off. *Pocket Filter* ($99.99): filters a variety of MIDI parameters. *Pocket Sequencer* (under $200): portable composition tool records 15,000 MIDI events. All units are small and require no batteries or AC adapter. Prices are in U.S. dollars.

Aphex Systems (13340 Saticoy St., North Hollywood, CA 91605; tel. [818] 765-2212). *The Feel Factory* ($795): manipulates MIDI timing/velocity data, in real time, to improve the feel of quantized sequences or compensate for delays; includes SMPTE reader/generator and SMPTE/MIDI converter. *Studio Clock* ($595): SMPTE to MIDI converter creates tempo maps from a live drummer, MIDI note on message, or recorded program material, allowing (among other things) MIDI sync to existing tape tracks. *Impulse* ($695): 12-input, percussion-triggering system for high-speed

drum pad/trigger-to-MIDI conversion.

ART (215 Tremont St., Rochester, NY 14608; tel. [716] 436-2720). *SGE Super Studio Effector* ($649): up to nine simultaneous effects, including exciter, noise gate, expander, limiter, compressor, envelope filter, overdrive, distortion, stereo flange, stereo echo, stereo delay, stereo chorus, equalization, panning, pitch transpose (two octaves), reverse and gated reverbs, and standard reverb. *Delay System VII* ($499): programmable delay system featuring 20 Hz to 20 kHz bandwidth, knobs for fast "tweaking," sampling capabilities, and user patch storage.

Audio Media Research (division of Peavey; 711 A St., Meridian, MS 39302-2898; tel. [601] 483-5372). *AEQ 2800* ($449.99): 28-band EQ with MIDI-controllable "virtual sliders" and 128 program memories. *QFX 4X4* ($1,149.99): four *independent* (effects can be used individually or in series if desired), 16-bit, digital, multi-effects processors in 1U package. All 128 programs are accessible via MIDI.

Blank Software (1477 Folsom St., San Francisco, CA 94103; tel. [415] 863-9224). *Alchemy 2.0* ($695): includes time compression/expansion, digital tuning, pitch shifting, envelope superimposition, and automatic pitch quantization. *Alchemy Apprentice* ($345): essentially replaces Alchemy 1.2.

Boss (7200 Dominion Circle, Los Angeles, CA 90040-3647; tel. [213] 685-5141). *WS-100* ($750): diversity, 170 MHz, wireless system. *GL-100 Guitar Driver* ($450): tube-simulation line driver with two separate channels. *BE-5 Guitar Multiple Effects* ($425): non-programmable effects system with compressor, distortion, chorus, noise suppressor, and digital delay.

Cannon Research Corporation (13338 Loma Rica Dr., Grass Valley, CA 95945; tel. [916] 272-8692). *Frontal Lobe:* expands the capacity of the Korg M1's sequencer ($399 for 15,000 events; additional $398 for upgrade to 64,000 events). Optional, 1.4-megabyte, floppy disk drive ($399) adds librarian features (can save and load songs, programs, system exclusive data, and combinations).

dbx (71 Chapel St., Newton, MA 02195; tel. [617] 964-3210). *120XDS* ($349): 1U rack-mount, subharmonic synthesizer with phase-coherent, subwoofer crossover output (adjustable from 50 to 210 Hz).

ddrum (25 Lindeman Dr., Trumbull, CT 06611; tel. [203] 374-0020). *ddrum 2*

• WHAT'S NEW

($4,995 for brain): sampled drum sounds with editable parameters, 64 non-volatile memory locations for storing different "kits," accessory sound cartridges available, rack-mount packaging, built-in mixer.

Digidesign (1360 Willow Rd., Suite 101, Menlo Park, CA 94025; tel. [415] 327-8811). *Sound Tools:* consists of *Sound Accelerator* Digital Signal Processing Card ($1,295), *AD IN* analog-to-digital converter ($995), and *Sound Designer II* ($995); brings 16-bit digital audio recording/editing to hard disk-equipped Mac II or SE.

Dynaware (1163 Chess Dr., Suite J, Foster City, CA 94404; tel. [415] 349-5700). *Ballade:* ($195) IBM-compatible MIDI sequencer/editor for the Roland MT-32, with nifty "mixing board" sequencer controls, notation display, and graphic editor.

E-mu Systems (1600 Green Hills Rd., Scotts Valley, CA 95066; tel. [408] 438-1921). *Proteus* ($995): 16-bit sound module featuring sounds ported from the Emulator III, including pianos, organs, strings, horns, guitars, basses, drums, Latin percussion, and more. Also, sound editing, extensive modulation/control routing, 32-voice polyphony, six polyphonic outputs, alternate tuning capability, integral sends and returns, and 192 presets.

Ensoniq (155 Great Valley Parkway, Malvern, PA 19355; tel. [215] 647-3930). *EPS-M Performance Sampler Module* ($3,295): rack-mount EPS sampler includes 1-megaword sample memory, SCSI port, and ten polyphonic outputs. *Signature Sound Series EPS disks* ($39.95 per set): three-disk sets of EPS sounds created by Nile Rogers, Claude Gaudette, Craig Anderton, David Hentschel, Paul Jackson Jr., and John Robinson.

Invisible Products (159 Commercial St., Lynn, MA 01905-2909; tel. [617] 592-5992). *Modular Furniture* line: designed to house workstations, computer setups, music setups, office equipment, etc.; lightweight, low profile.

Johnsware (5802 42nd Ave., Hyattsville, MD 20781-1632; tel. [301] 927-1947). *MIDIBOSS* ($99.95): Atari ST MIDI system setup software stores and sends MIDI system configurations (program changes, instrument names, system exclusive info, etc.).

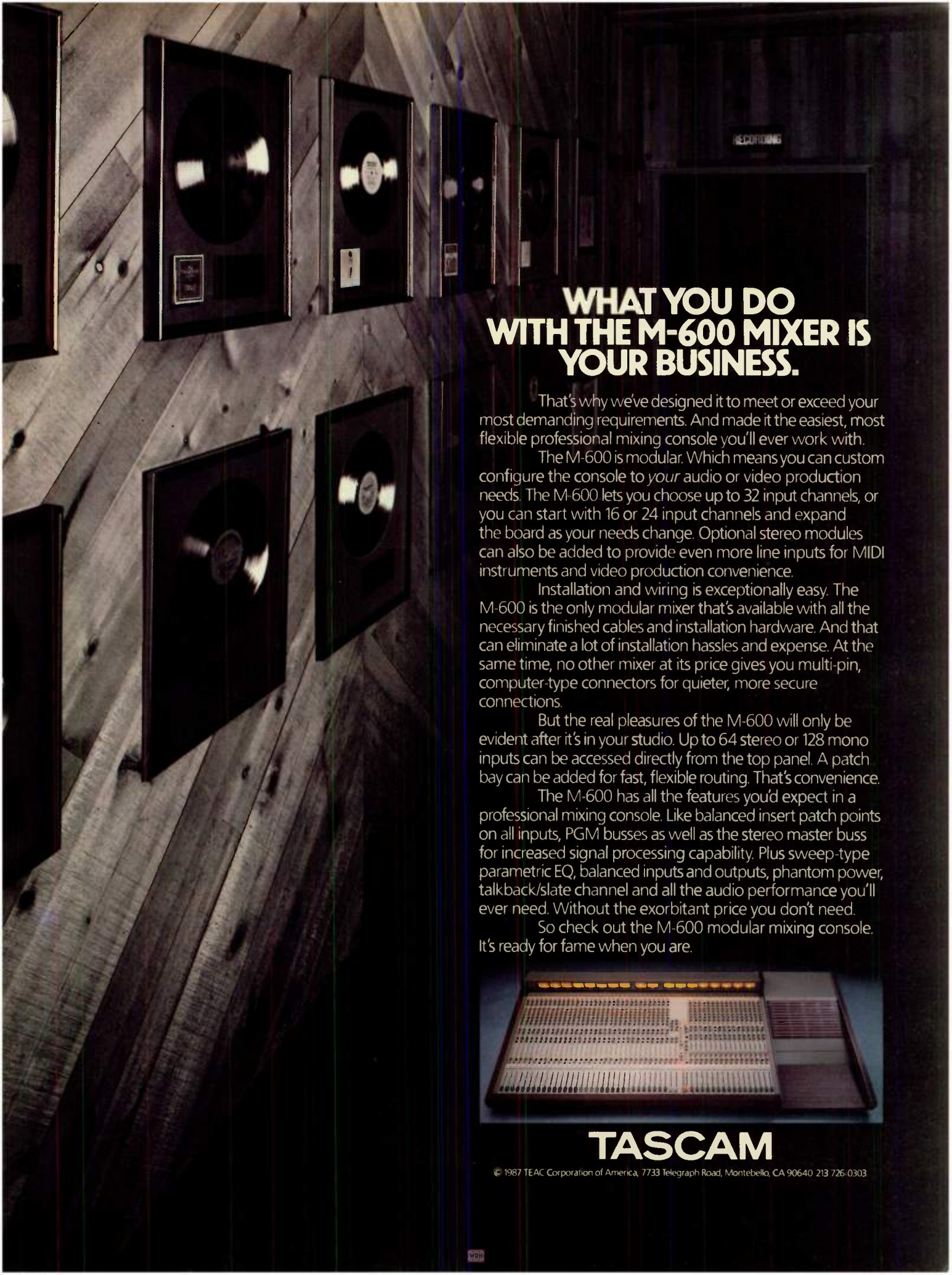
Keyboard Technologies, Inc. (16137 Sherman Way, Suite 169, Van Nuys, CA 91406; tel. [818] 891-6999). *GZ-1000* ($3,995 with one variable footpedal and one dual footswitch): upscale master keyboard with adjustable hammer action (!), internal disk drive, user-definable velocity scaling, eight MIDI out ports, two MIDI in ports, MIDI merge and filtering, and extensive footswitch/footpedal control.

Alesis HR-16B drum machine

Korg (89 Frost St., Westbury, NY 11590; tel. [516] 333-9100). *T1:* enhanced version of the M1 includes 88 weighted keys, eight megabytes of 16-bit PCM sounds, internal disk drive, more sequencer storage (approx. 60,000 notes), and a great-looking display. *M1R:* rack version of M1 keyboard. *S1:* 16-bit, stereo sampler with 1 MB of sounds in ROM, sample memory expandable from 512K to 2 MB, 16-track sequencer syncs to SMPTE/MTC/MIDI clock; options include SCSI, digital I/O, and four additional outputs. *Z3:* MIDI guitar synth brain and driver features onboard, 6-voice synth with 128 internal programs.

Kurzweil (411 Waverly Oaks Rd., Waltham, MA 02154; tel. [617] 893-5900). *MS-1 MicroSequencer* ($495): easy-to-use, consumer-oriented sequencer plays back prerecorded SongCards in addition to recording; 8,000 notes, four tracks, and a card slot for extra storage on MemoryCards. *K1000 Special Edition* ($2,595): K1000 with aftertouch; non-volatile, MIDI-channel status memory; aftertouch sent over MIDI (with programmable mapping); expandable with the KXA-SE Sound Block; many new sound setups. *1000 AX Plus* ($2,395): new set of orchestral programs based on 1000 HX Horn Expander and 1000 SX String Expander sound ROMs. Features new front panel and the "Plus" series advanced operating software.

Lake Butler Sound Company (5331 West Lake Butler Rd., Windemere, FL 32786; tel. [407] 656-5515). *CFC-4 Continuous*



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Installation and wiring is exceptionally easy. The M-600 is the only modular mixer that's available with all the necessary finished cables and installation hardware. And that can eliminate a lot of installation hassles and expense. At the same time, no other mixer at its price gives you multi-pin, computer-type connectors for quieter, more secure connections.

But the real pleasures of the M-600 will only be evident after it's in your studio. Up to 64 stereo or 128 mono inputs can be accessed directly from the top panel. A patch bay can be added for fast, flexible routing. That's convenience.

The M-600 has all the features you'd expect in a professional mixing console. Like balanced insert patch points on all inputs, PGM busses as well as the stereo master buss for increased signal processing capability. Plus sweep-type parametric EQ, balanced inputs and outputs, phantom power, talkback/slate channel and all the audio performance you'll ever need. Without the exorbitant price you don't need.

So check out the M-600 modular mixing console. It's ready for fame when you are.

TASCAM

Switch Controller ($295): battery-operated, assignable (can assign command strings long enough to control sixteen parameters at once), quad pedal device sends MIDI continuous controller data with eight different pedal response curves.

Magnetic Music (6 Twin Rocks Rd., Brookfield, CT 06804-1910 (tel. [203] 775-7832). *Prism* ($99): IBM sequencer by John Lilley, Roger Powell, and Ralph Bellofatto that is *Texture* file-compatible and features graphics-oriented presentation, mouse support, high-res color graphics, mapping, sixteen tracks, cut-and-paste song editing, swing functions, and more. Note: the Magnetic Music product line is now compatible with the Yamaha C1 computer.

McGill University (555 Sherbrooke St. West, Montreal, Quebec, Canada H3A 1E3; tel. [514] 398-4535). *Master Samples* ($69 per volume, $199 for any three): eight new volumes of samples on CD, including Rock Percussion and Tympani, Rock Strings, Latin Grooves #1, Latin Grooves #2, Jazz Sounds, More Strings/Winds/Piano/Percussion, Pipe Organ, and Historical Instruments.

Midia (dist. by IMC, PO Box 2344, Fort Worth, TX 76113; tel. [817] 336-5114). *MusicBox* ($999.95): expander tone module with 26 dynamically allocated voices, 1,092 sounds, and direct interfacing with Apple IIGS/Mac/Amiga/ST. Includes FM, analog, and sampled sounds and is patch-compatible with FB-01 and JX-8P editor/librarians.

Cannon Research Frontal Lobe

MIDImouse Music (Box 877, Welches, OR 97067; tel. [503] 622-4034). *Ultra MIDI* ($229.95): Atari ST MIDI system control software features generic bulk librarian, ability to load/play Standard MIDI Files, mapping (controller reassignment, inversion, etc.), velocity scaling, MIDI clock-out control, MIDI rerouting, extensive remote control, and more. *Wave* ($249.95): Amiga software for 12-bit samplers generates samples using additive, wavetable, FM (can be of two different samples, not just sine waves), granular, phase modulation, and AM synthesis techniques; filtering; 16-stage amplitude and pitch envelopes; and chorus/flanger.

Musicsoft (1560 Meadowbrook, Altadena, CA 91001; tel. [818] 794-4098). *MIDIMAN Tape Recorder Interface* ($179.95): records MIDI sequence data on tape for later playback; take a cassette recorder to gigs instead of a computer and play back sequences from tape into your MIDI gear. *G10 Editor/Librarian* ($99.95): IBM-compatible editor/librarian for the Yamaha G10 works with all

Korg M1R module

graphics cards. Musicsoft also offers editor/librarians for other gear and IBM/Atari ST/Amiga computers.

Oberheim (2015 Davie Ave., City of Commerce, CA 90040-1704; tel. [213] 725-7870). *Navigator* ($299): MIDI accessory can reassign controllers, map notes, and control patch changes; includes panic button, patch offsetting, and controller filtering. *OB-8k* ($1,295): multitimbral, 8-voice, keyboard version of the Matrix-1000 with velocity; aftertouch; assignable pedals; stereo, assignable outputs. Stores 100 setups.

Opcode Systems (1024 Hamilton Ct., Menlo Park, CA 94025; tel. [415] 321-8977). *Vision* ($495): Macintosh sequencer features event list and graphic editing, 480 ppqn resolution, SMPTE sync, sequence chaining, algorithmic capabilities, loop recording, extensive mapping capabilities, online help, assignable fader module for MIDI continuous controllers, controller/program change chasing, and more.

Passac (759 Ames Ave., Milpitas, CA 95035; tel. [408] 946-8989). *Unity Eight* ($445): 1U, 8 x 4 mixer with balanced and unbalanced stereo outputs; 95 dB signal-to-noise ratio at +4 dBm; pan; mono compatibility; and two separate stereo sends/returns.

Passport Designs (625 Miramontes St., Half Moon Bay, CA 94019; tel. [415] 726-0280). *Escort* ($250): IBM-compatible software imports Standard MIDI Files and *Sequencer Plus* files and translates them into *Score* format for music-publishing applications.

Peavey (see Audio Media Research address). *DPM-3 Synthesizer* (approx. $2,000): features dynamic allocation, velocity/pressure-sensitive keyboard, 32 oscillators (16-bit, PCM samples; new sounds can be loaded via MIDI/disk/memory card), 16-voice polyphonic, multitimbral, internal signal processing with assignable inputs/outputs, 100 patches (extra 200 accessible via memory card), digital filters with resonance, disk drive, drum samples, 9-track/20,000-note sequencer, and more.

Playstation (4141 Ball Rd., Suite 229, Cypress, CA 90630; tel. [213] 598-0505). *The Playstation* ($6,500 for Mothership 200 model): modular, highly ergonomic housing system for installations that include shelf- and rack-mount gear, keyboards, and computers; available in several different configurations.

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● WHAT'S NEW

Prosonus (1616 Vista Del Mar, Hollywood, CA 90028; tel. [800] 999-6191). *Studio Reference Disc* ($49.95): 70-minute CD for control-room monitor tests and other studio, broadcast, and laboratory applications; contains audio test and reference tones, white and pink noise (1/3-octave and full-band), polarity test, pitch references, leader test, and more. Prosonus also introduced several new instrument CDs for sampling.

Rane (10802 47th Ave. West, Everett, WA 98204; tel. [206] 355-6000). *MPE Series Programmable Equalizers*: 128 program memories, constant-Q filtering, non-volatile memory, MIDI control of individual faders, balanced ins/outs. Available models include: single-channel, 28-band (1/3-octave); stereo, 14-band (2/3-octave); 4-channel, 7-band (octave). *SM82 Stereo Line-Level Mixer* ($599): utility mixer with eight stereo inputs, stereo input-level controls, stereo aux-send levels, and pan sliders. Expandable to sixteen stereo inputs.

Resonate (PO Box 996, Menlo Park, CA 94026; tel. [415] 323-5022). *Portrait* ($495): Macintosh sequencer features both event list and graphic editing, ability to name channels and programs, modular structure (add more modules as they're developed), interactive operations (most editing can be done while the sequence is playing), 480-ppqn resolution.

Roland (see Boss address). *R-5 Human Rhythm Composer* ($695): little brother to the R-8 has fewer outputs, less memory, and doesn't accept external sound cards. *D-5* ($995): entry-level, multitimbral, L/A synthesizer with 128 preset/64 user-programmable sounds, including drum sounds. *GR-50* ($1,549.50): guitar synthesizer, L/A synthesis sound source (similar to D-110), and MIDI converter in 1U package; retrofits existing guitars; maximum 8 ms delay. *U-110* ($1,095): 31-voice sample playback device with 99 different sounds; accepts up to four ROM cards for additional sounds. *W-30 Music Workstation* ($2,795): 16-track sequencer; keyboard; eight outputs; 16-voice, 12-bit, linear sampler with 16-bit processing; SCSI interface; downward compatibility with Micro Composer-series products.

Scholz Research & Development (1560 Trapelo Rd., Waltham, MA 02154; tel. [617] 890-5211). *XP 100* ($1,098): 100-watt, compact, portable, stereo amp with 100 programs; MIDI-programmable EQ, chorus, reverb, and master volume; distortion—and great sound. *XPR* ($849): rack-mount version of the programmable multiprocessor section in the XP 100.

Sound Quest (5 Glenaden Ave. East, Toronto, Canada M8Y 2L2; tel. [416] 234-0347 or [800] 387-8720). *K1 Master Editor/Librarian* and *Matrix-6/1000 Master Editor/Librarian* ($165 each): for IBM, C1, and Amiga; allows for editing multiple patches simultaneously and generates random patches or patch variations. Also, the D-10, D-20, and D-110 editor/librarians have been combined into a single program ($165) as have the DXII and TX802 editor/librarians ($190).

Soundcraft USA/JBL Professional (8500 Balboa Blvd., Northridge, CA 91329; tel. [818] 893-8411). *Seck Consoles*: the popular Seck console line is now distributed by Soundcraft in the U.S. and Mexico. Consoles are available in frame sizes up to 24 inputs. *Twister Console Automation software:* developed in conjunction with Steinberg for the Atari ST, this software for the Twister automation system supports SMPTE time code (all formats); cue lists; graphic, channel level editing; enveloping; and snapshot capabilities; and includes a SMPTE calculator.

Twister automation

Spectral Synthesis (18568 142nd Ave. NE, Woodinville, WA 98072; tel. [206] 487-2931). *SynthCARD Dual DSP Board*: IBM-compatible Digital Signal Processing "engine" is essentially a computer designed specifically for music and sound applications; turns PC/XT/AT machines into digital audio workstations.

Seck consoles

Prices range from $1,995 for a "starter kit" (including the Audio CAD algorithmic sound-development software) to $18,500 for a fully loaded system.

Steinberg/Jones (17700 Raymer St., Suite 1002, Northridge, CA 91325; tel. [818] 993-4091). *Cubit* ($495): Atari ST sequencer works under the M.ROS true-multitasking operating system for musical applications. Multiple windows, 384 ppqn resolution, innovative quantization (with user-programmable "groove" quantizing), MIDI effects processing, real-time controller mapping, slick user interface. *Mimix* automated mixdown software and the *Synthworks M1* editor/librarian also run under M.ROS.

Tascam (7733 Telegraph Rd., Montebello, CA 90640; tel. [213] 726-0303). *TSR-8* ($3,499): half-inch 8-track includes most of the same features as its half-inch, 16-track "big brother." *MM-1* ($1,099): keyboard mixer with programmable mutes, recallable under MIDI control.

Technics (1 Panasonic Way, Secaucus, NJ 07094; tel. [201] 348-7000). *MQ8 MIDI Sequencer*: eight tracks; 23,000-note storage; built-in 3.5-inch disk drive that stores about 90,000 notes; program-change chase; sys ex compatibility. Editing features include punch, repeat, copy, delete, merge, and quantize.

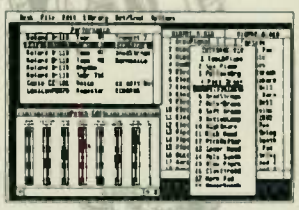
Yamaha (6600 Orangethorpe Ave., Buena Park, CA 90620; tel. [714] 522-9011). *V80FD* ($2,995): 6-operator, 16-bit, FM, digital synthesizer with onboard expansion port; 40 x 8 supertwist LCD; disk drive; 32-track onboard sequencer with digital mixing/individual note editing; built-in, programmable delay/reverb/distortion; and dynamic voice allocation. Expansion cards add PCM sampled sounds, RGB video interface card, and sequencer memory upgrade. *V50* ($1,895): dual, 4-op FM synthesizer includes built-in, PCM drum machine; 8-track sequencer with 15,000-note storage; 32 digital effects; disk drive; instant access to 300 voices; and dynamic voice allocation. *DS55* ($795): 4-op, FM synth includes 200 onboard voices (and 100 external), auto-accompaniment, arpeggiator, and built-in digital delay. *WX11* and *WT11* ($995): MIDI wind controller packaged with tone generator (available separately) for "plug in and play" ease of use. *TQ5* ($695): all-in-one tabletop unit includes 100 preset voices and 100-voice user memory, signal processing, and 8-track sequencer. Eight-note polyphony, eight-note multitimbral.

Zeta Music Systems (2230 Livingston St., Oakland, CA 94606; tel. [415] 261-1702; outside California [800] 622-6434). *Mirror 6* ($2,995 standard system, $3,795 deluxe system): this MIDI guitar has had the longest gestation of just about any product we've ever seen, but the latest version works quite well. ■

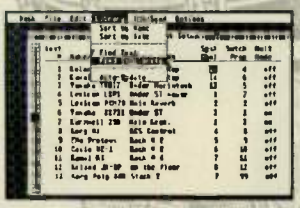
X-or™

Your system exclusive orchestrator

X-or treats your entire MIDI setup as if it were just one big instrument. Our 5 years of knowledge and experience in the field of patch editor/librarians made it possible for us to create a highly integrated system for patch editing, storage and retrieval. X-or's advanced Performance commands can get, send, load, or save patches from every instrument in your setup with a single click of the mouse. And with its Setup Editor, you can customize X-or for your MIDI equipment setup. Whether you have 16 identical Instruments, or 100 different Instruments, **X-or can handle it.**



Designed for the future, X-or takes full advantage of its multi-window environment, with movable, resizable windows for greater flexibility. It is a modular system, using "Instrument Profiles"—files containing everything it needs to know about a specific Instrument. With our optional X-or Profile Editor, you can even create an X-or Instrument Profile for virtually any Instrument that converses in *"System Exclusive."* These Instrument Profiles may be freely copied, traded, or even downloaded from bulletin boards. As long as MIDI exists, X-or will never become obsolete.



X-or is a bona fide Patch Editor for any MIDI Instrument. Parameters may be directly edited by sliders, buttons, and graphic envelope displays. With X-or's Transplant feature, sections of a patch (for example, a DX operator or a D-110 partial) may be copied between patches. Also, X-or has four types of Randomization—Blending, Mingling, Transplanting and Randomize with Mask—each of which use existing patches to generate banks of new patches with a few clicks of the mouse.

Once you've edited a patch and stored it, you won't have any trouble finding it. X-or's extensive search and sort features give you the convenience of a database for organizing your patches.

Other features include:

Patches and banks for all instruments kept in memory for instant access;
Number of banks in memory is limited only by memory size;
Click and Drag method for Copying, Moving or Swapping patches between banks;
Four bank windows open on screen simultaneously;
Comments for all Patch, Bank, and Performance files;
Intelligent MIDI Switcher control for HANDS-OFF operation;
Smart multi-timbral instrument handling;
Mouse-Play feature; play any note, velocity or controller with the mouse;
Bank files are compatible with our existing Editor/Librarians;
Atari ST version has MPE compatibility, contains Desk Accessory version;
Amiga version is fully multi-tasking;
Mac version is Multifinder compatible.

Partial List of Instruments Supported:

ART: Multiverb
Casio: CZ-101, 1, 1000–5000, VZ-1
Digital Music: MX-8
Digitech: DSP-128
Ensoniq: ESQ-1, ESQ-M, SQ-80
J.L. Cooper: MSB+
Kawai: K1, K3, K5
Korg: M1, DS-8, 707, DSS-1, DSM-1, Poly 800
Lexicon: LXP-1, PCM-70
Oberheim: Matrix-6/1000, Matrix 12, Xpander
Roland: D10, D20, D110, D50, D550, MT32, JX-8P, GM70
Yamaha: DX1, DX5, DX7, DX9, DX11, DX7II, DX7S, DX21, DX27, DX27S, DX100, TF1, TX7, TX802, TX216, TX816, TX81Z, FB-01, RX5, RX7, RX11, SPX90, REV7, DMP7.
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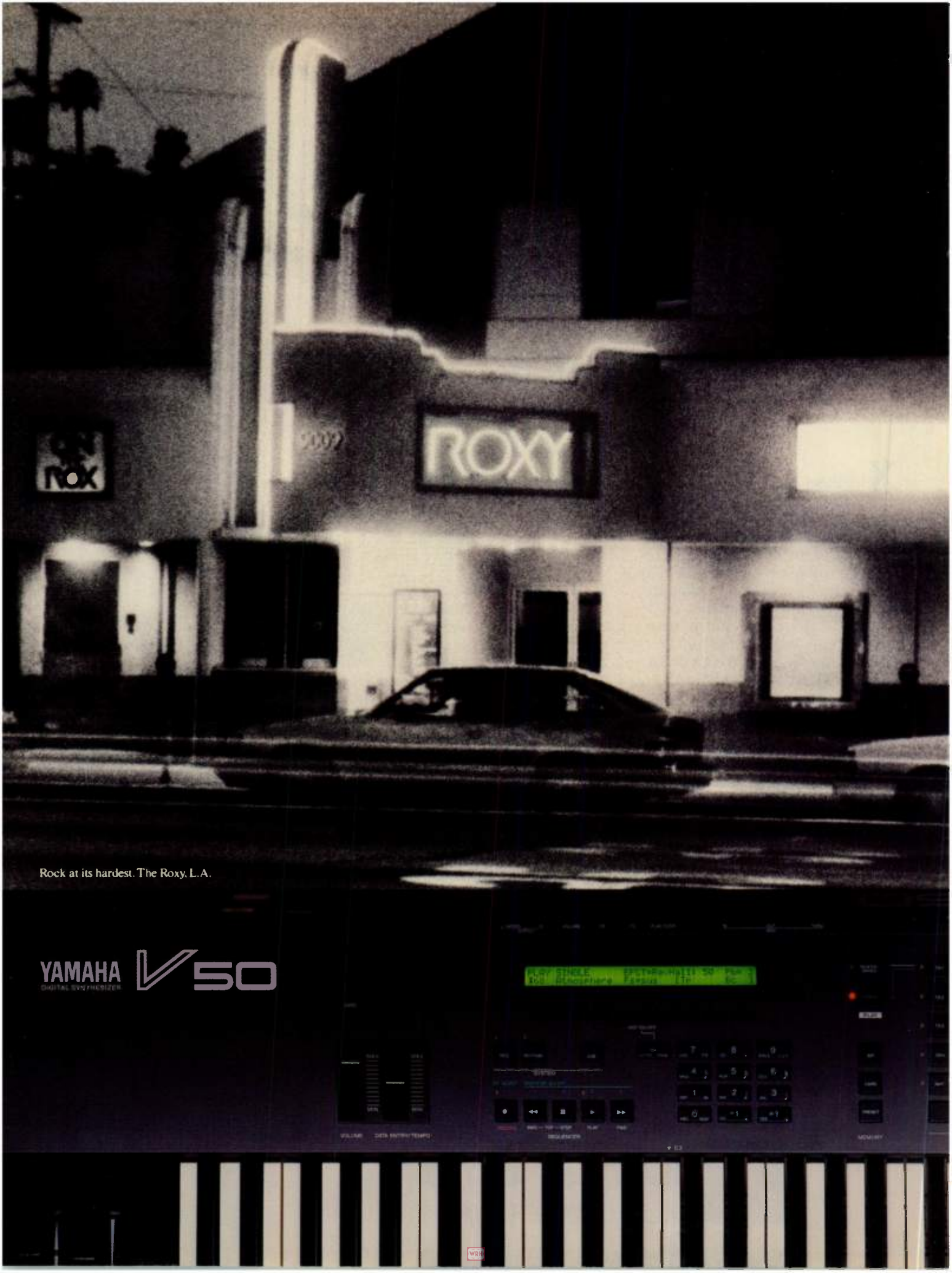
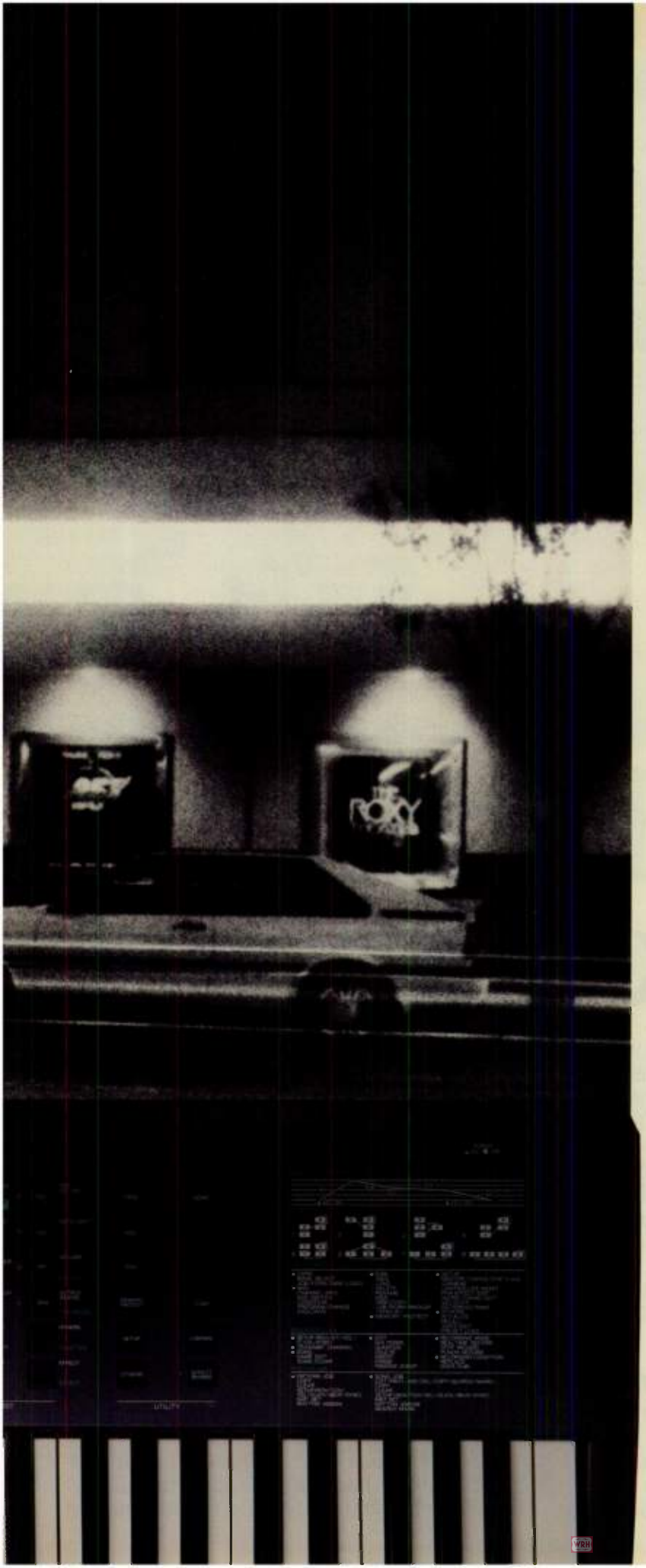


Rock at its hardest. The Roxy, L.A.



THE DIFFERENCE BETWEEN BLOWING IT. AND BLOWING THEM AWAY.

There are no second takes when you're playing live.

With that scary thought in mind, we designed the ultimate live performance synthesizer.

The Yamaha® V50. Instead of your keyboard, drum machine, sequencer and effects being all over the place, we put them all in one place.

You've got an 8-timbre, 16-note polyphonic synth that gives you access to over 10,000 FM voices. A drum machine with 61 sampled sounds. An 8-track sequencer that stores up to 16,000 notes. And digital effects like reverb, delay, distortion and gating.

All at your fingertips.

To simplify things even more, the V50 has dedicated keys for functions you use a lot. And it'll store performance setups on a floppy disk.

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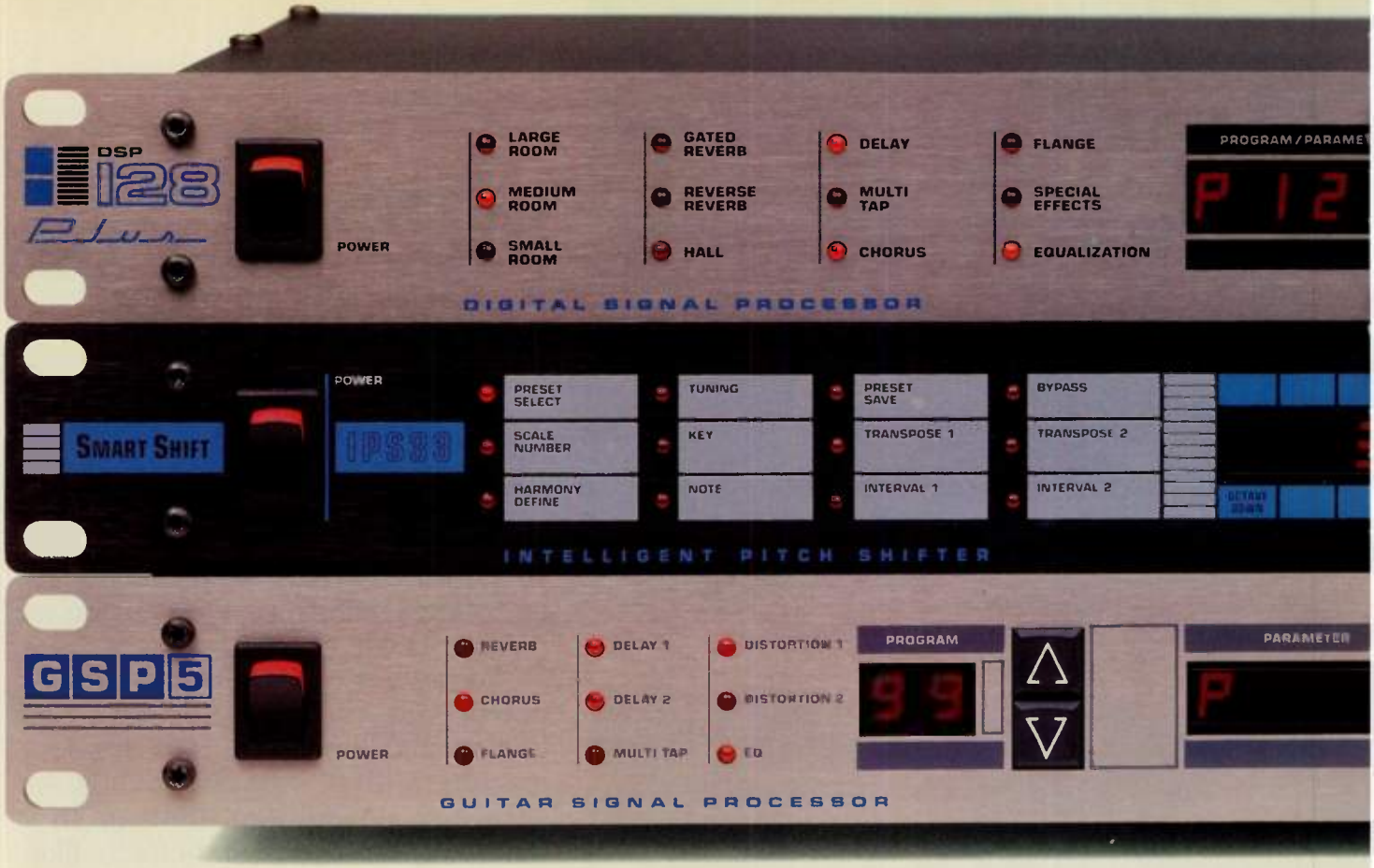
Yamaha Corporation of America, Digital Musical Instrument Division, P.O. Box 6600, Buena Park, CA 90622. In Canada: Yamaha Canada Music Ltd., 135 Milner Avenue, Scarborough, Ontario M1S3R1.



The next gener effects processor

Just shows you what can happen when you leave the guys in R&D to their own designs.

Now DigiTech introduces three new digital effects processors that will blow you away with their innovation and flexibility:

The new DSP-128 *PLUS*. The incredible IPS-33 Smart Shift. And the extraordinary GSP-5. A trio of performers versatile enough to handle any multi-effects challenge you can create.

Use each separately or connect them in series. Either way, you're in for the performance of your life.

DSP-128 Plus: Four effects at once.

The remarkable new DSP-128 Plus offers the capability of producing up to four digital effects at the same time along with an enhanced 20 Hz to 20 kHz bandwidth.

The new DSP-128 Plus is a studio-quality, performance-oriented multi-effects processor. In one compact rack-mount unit you get reverb effects, chorusing, flanging, delay, multi-tap delay and parametric equalization. And you can produce up to *four* effects simultaneously.

What's more, the DSP-128 Plus is fully programmable, with 128 user-defined memory slots. And it offers MIDI continuous control for virtually unlimited real-time programming power.

The custom 20-bit VLSI engine produces unbelievable dynamic range and computing power. *Plus* we've made the front panel a masterpiece of simplicity.

The DSP-128 Plus can enhance the creative power of any serious musician.

IPS-33 Smart Shift.

The IPS-33 Smart Shift is an intelligent pitch shifter that lets you add one or two crystal-clear harmony notes to each one you

ation of digital
s from DigiTech.

play or sing. Without overdubs, and with any instrument.

Now you can generate intelligent, user-defined harmonies in 41 different scales. From natural minors and chromatics to Phrygian and Mixolydian. Best of all, the pitches it generates are clean and free from distortion.

The serious technology in the IPS-33 frees you to create complex, three-part guitar harmonies in the style of Les Paul and Mary Ford, Duane Allman and Dickey Betts—even Steve Vai. With only one instrument.

GSP-5: 5 effects at the same time for guitar players.

Now there's a versatile rack-mount signal processor any guitarist can call his own.

It's the new DigiTech GSP-5.

Choose from six killer reverb effects, plus chorusing, flanging, delays up to 1.5 sec., infinite repeat, distortion and parametric EQ. And you can produce up to *five* effects at the same time.

The GSP-5 is fully programmable, with 99 user-defined memory slots. And MIDI continuous control allows you to instantly change operating parameters for virtually unlimited, real-time programming power.

The versatile GSP-5, with its combination of effects, including distortion plus programmability, is one of the hottest guitar signal processing tools you can buy.

Check out all three at your DigiTech dealer. They're packed with technology *and* value, too. For a full-color product sheet, write DigiTech, 5639 South Riley Lane, Salt Lake City, Utah 84107. Or call (801) 268-8400.

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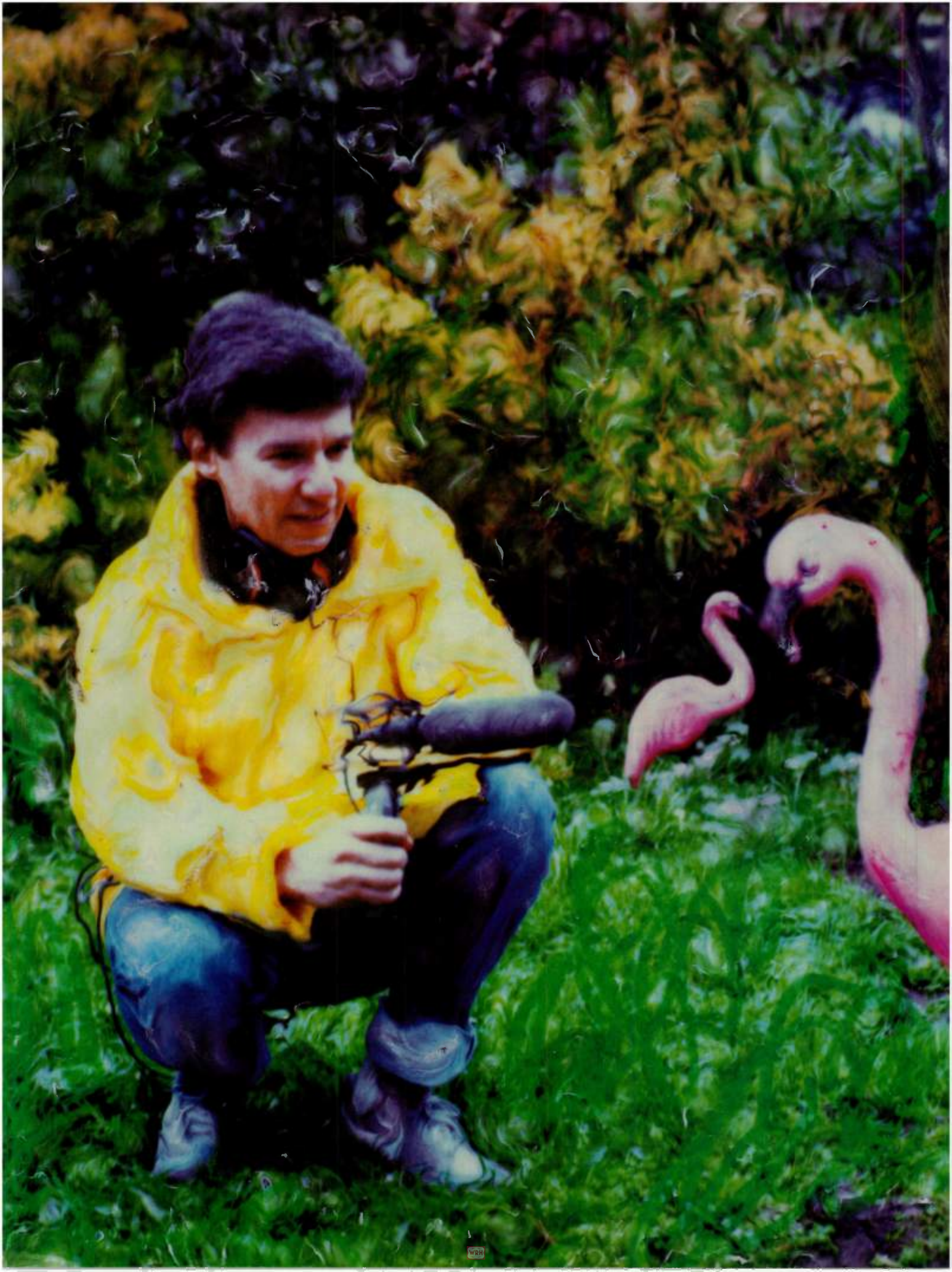


MARK TROUSDALE

A virtuoso explains how to record and use the sounds of the Earth.

Making Music with Nature:

Bernie Krause Samples Life

At 50, Bernie Krause has been immersed in the field of electronic music for a quarter century. He appeared on the first commercial album to feature synthesizer (*The Zodiac*, 1967) and with his late partner, Paul Beaver, was instrumental in introducing the synthesizer to popular music through personal appearances and guest spots on over a hundred albums. He has done soundtrack work for more than 160 films and television shows. In 1981, he returned to college and gained a Ph.D. in bioacoustics. In addition, he is often called upon as a consultant and expert witness on recording and editing technology.

Most recently, Krause collaborated on two "instrumental" dance singles, "Fish Wrap" (with Matt Ward and Scott Singer) and "Jungle Shoes" (with Matt Ward, Tony Mills, Frank Martin, and Peter Michael Escovido), for the Rykodisc label. Both efforts used only sampled, biological sounds. These singles have brought Krause much media attention, helping him get his message across. That message is the driving force in his life these days. In an effort to reach out to people—especially school children—who might not hear his environmentalist message or his other music, Krause decided, "If you can get them dancing in the aisles, it will break the ice, and you can hit them with all the environmental stuff you want."

By Steve Oppenheimer with Robert Carlberg

The reason to buy an Otari is because it's *your* music.

If you have a personal studio, Otari lets you choose exactly the right audio machine for *your* kind of music. Because no one audio machine can be everything to everybody, we build a complete line of superb machines that, alone or working together, will fit your application perfectly.

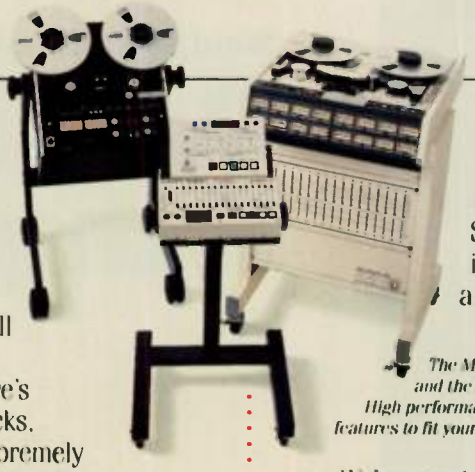
The 8-track MKIII-8 and the MX-50 2-track. Professional sound and features at an affordable price.

For example, our MX-55NM quarter-inch 2-track delivers gapless, seamless, punch-in, punch-out for flawless edits, and HX-Pro* for increased headroom.

And if you're on a *really* tight budget, check out the new MX-50, a quarter-inch 2-track mastering machine with 3 speeds and 10.5" reels at a price that will astound you!

Then there's the multitracks, from the supremely affordable half-inch 8-track MKIII-8 with both 7.5 and 15 ips speeds, to the two-inch 32-track MX-80 with its full-function remote controller, 30/15/7.5 ips speeds, spot erase, and gapless, seamless, punch-in/out.

The MX-80, (and its little brother, the one-inch, 16-track MX-70) share a constant-tension, servo-controlled transport, plus the Otari 37-pin standard parallel interface for SMPTE synchronizers, editors, and controllers.



The MX-70 multitrack and the MX-55N 2-track. High performance and enhanced features to fit your creative energies.

We're convinced that somewhere in this line of great sounding audio machines there's one that will fit your music to a note.

Call us at (415) 341-5900 for complete information on any one, or all. Better yet, call your nearest Otari dealer for a demo!

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Otari's MX-80 multitrack and the new MX-55NM 2-track. Alone or together, the ultimate choice for your personal studio.

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MAKING NATURE COME ALIVE

Many of Krause's pieces represent an artificial reconstruction of an original natural ambience. Having accumulated and processed a set of species-specific sounds, he constructs a "bed" on which to reposition and reconstruct his creatures in a way that creates the *feeling* that we are among the animals in their habitat. He does not simply lay down his recordings of local and regional ambient sound, however, but "assembles" them, taking into account two major factors: our ears and brains hear selectively, unlike the microphone; and Krause's material has already been taken out of context by the recording process. He feels natural sound recordings tend to be static and two-dimensional, and says, "Most people stick one or two microphones out there; environmental tapes generally haven't been structured in a way that gives us the illusion that we're actually present in that environment. You have to compensate for that at the mixing board.

"Paul Winter and I were talking about recording his group in the Grand Canyon to try to capture the spirit, if you will, of the place through microphones. I have problems with that, because the minute you extract a quality from the environment and send it to tape, it's no longer what it was. Even the best mic never picks up the true ambience of a place. So you have to use the studio to reposition the sounds in such a way that they come alive and acquire the dimension and lyricism that's always present in nature."

Recording natural sounds takes great patience. When Krause is recording *ambient acoustic biospectra* (see sidebar, "Acoustical Bio-What?"), he records five-minute samples every hour for 24 hours. He gets as much as time and conditions allow, always impeded by weather, moisture, and endless field problems. In one month of

ACOUSTICAL BIO-WHAT?

According to Webster, bioacoustics is the branch of science that studies the relation of living beings and sound. Bernie Krause is a proponent of the theory that each location on Earth has a unique environmental aural ambience. He noticed that "every time I moved 100 yards from one location to another, even if there was virtually no change in the environment, the sounds were different. Each location on Earth has its own voice, just as we have our own voice."

The spectrographic footprint of a location is its *acoustical biospectrum*. Krause theorizes that for a given time of year, time of day or night, weather, and other natural phenomena, these ambient sounds are constant. When one voice drops out, another will eventually take its place in the same area of the spectrum, i.e., a creature fills the available frequency window, keeping intact, over time, the unique acoustical biospectrum of that place. This theory has been investigated with regard to bird songs, by other researchers.

Krause finds that insects create a constant din in one part of the spectrum, and the other creatures vocalize in different frequency ranges. In the light of natural selection theory, this is logical. Krause's spectrograms indicate there are regional patterns created by widespread species (such as insects) and local patterns caused by species that have a limited range. He tested these theories by recording over a period of several days, at approximately the same time of evening, in three locations 150 yards apart, with similar vegetation, at an altitude of 1,000 feet. The resulting spectrograms are compared to similarly recorded data in other parts of the world. So far, the results have been affirmative.

Krause speculates that changes in a particular acoustical biospectrum may indicate changes in the ecological balance of the location, and he hints at a tie to the Lovelock-Margolis "Gaia Hypothesis." He also thinks that mobile, wide-ranging creatures may use ambient sound as a beacon to find their own special habitats. "There's Earth orchestration and there's human orchestration," Krause states. "After all, composers have been trying to emulate nature ever since the beginning." Krause notes that all musical instruments started from observations of nature—the sound of a taut skin led to drums, wind in the reeds led to flutes—and composers of more recent centuries, such as Vivaldi (*Four Seasons*), Debussey (*La Mer*), and Beethoven (*Sixth Symphony*), openly emulated natural sounds with the orchestra. —*SO*

● **BERNIE KRAUSE**

recording the mountain gorillas in Rwanda, Africa (with photographer Nick Nichols), Krause recorded about twenty hours of material to get fifteen usable minutes. On most field projects, Krause works about twenty hours per day, but sometimes, as in Rwanda, he is limited to ten hours by the need to work with guides.

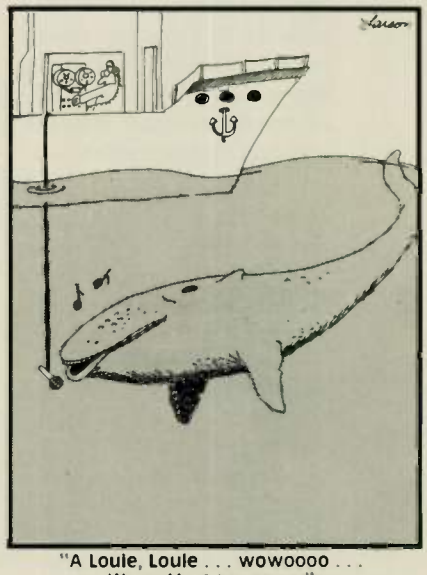
The equipment Krause uses falls into three categories: field equipment, his home studio (see sidebar, "The Wild Sanctuary"), and the gear he uses at Spark Studio in Oakland, California, where additional advanced tools are available. The studio gear, including the Emulator II and III samplers, is standard. His field "toys," however, are the critical link without which Krause's work would not be possible; they must resist all kinds of stress. Once, to avoid a charging gorilla, Krause had to dive into the Rwandan underbrush while carrying a full recording rig. Another time, his Nagra tape recorder fell 40 feet from a helicopter. The gear survived both incidents.

IT'S IN THE WATER

For underwater work, Krause records in monophonic. Sound travels much faster underwater than in air: at 21 degrees centigrade, approximately 4,987 ft./sec. in seawater, compared to approximately 1,128.6 ft./sec. in sea-level air at 50 percent humidity. This makes stereo recording pointless for Krause, who prefers to keep natural, reflected sounds when possible.

Underwater recording requires a specialized mic known as a *hydrophone*. "When we listen to sound underwater, there is an impedance mismatch and we lose high frequencies, because our ears are meant

continued on page 64



"A Louie, Louie . . . wowoooo . . . We gotta go now . . ."

MAJOR BREAKTHROUGH IN MUSIC TECHNOLOGY

Los Angeles, CA - Hybrid Arts, a leader in music computer technology, has again made history with the introduction of ADAP II...the direct to hard disk digital audio recorder/editor. ADAP is the acronym

for Analog to Digital Audio Processor. In short, ADAP is a digital mastering device and audio work station, a 16 bit stereo sampler, a visual non-destructive sound editor with sample precise accuracy, a MIDI module, a SMPTE trigger, full EDL (Edit Decision List), a cue system and much more.

ADAP delivers all the advantages of digital audio recording at a very affordable price. Among the extensive list of outstanding features, ADAP offers the user the ability to edit, manipulate and process sound without any loss of fidelity. And, by storing your original tracks in memory, you can perform multiple edits, add new sounds or sweeten...completely non-destructively.

ADAP has more speed, power and versatility than any tape-based system or even other digital recorders saving you valuable time, energy and money. For example, matching audio to visual hits via SMPTE can be performed instantly because ADAP responds in real time.

These features can be fully realized when performing editing functions. ADAP offers independent left and right channel editing. Multiple edit windows allow you to transfer sounds between files where they can be combined and manipulated in a variety of ways without clicks, glitchs or other unwanted noises. One feature that you're sure to appreciate is being able to see the X-cursor which displays its exact position in real-time or SMPTE code during record or playback. ADAP gives you the ability to drop and name markers at any point. These markers are your edit points and can be referenced quickly and accurately with autolocate for editing or playback of specific ranges. The zoom feature allows you to 'zoom-in' on any part of the sound file wave form or amplitude display for precise editing. This close-up view of the sound enables you to move your markers with microsecond precision. The cut, copy, paste, and insert time are valuable editing functions that give you complete control.

ADAP's optional AES/EBU digital interface and direct to disk capability makes it one of the few systems available for R-DAT editing (48 kHz sample rate) where the audio is kept completely in the digital domain. When compared with devices costing many times the price, ADAP stands up as one of the most flexible, capable and advanced systems available.

Here are just a few of the possible applications: For film/video post-production...ADAP is unsurpassed in speed and ease for effects editing, background looping, dialog, dialog fill or electronic foley. For recording studios...it's used as a one shot sampler to fly in vocals, retune sections of music or create extended mixes. For musicians & sound designers...it's a high quality MIDI performance sampler and digital synthesizer. For radio stations...it's the ultimate commercial spot production system.

ADAP is available as a stand alone product or can be supplied to order in a variety of turnkey system configurations.

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Opcode's New System

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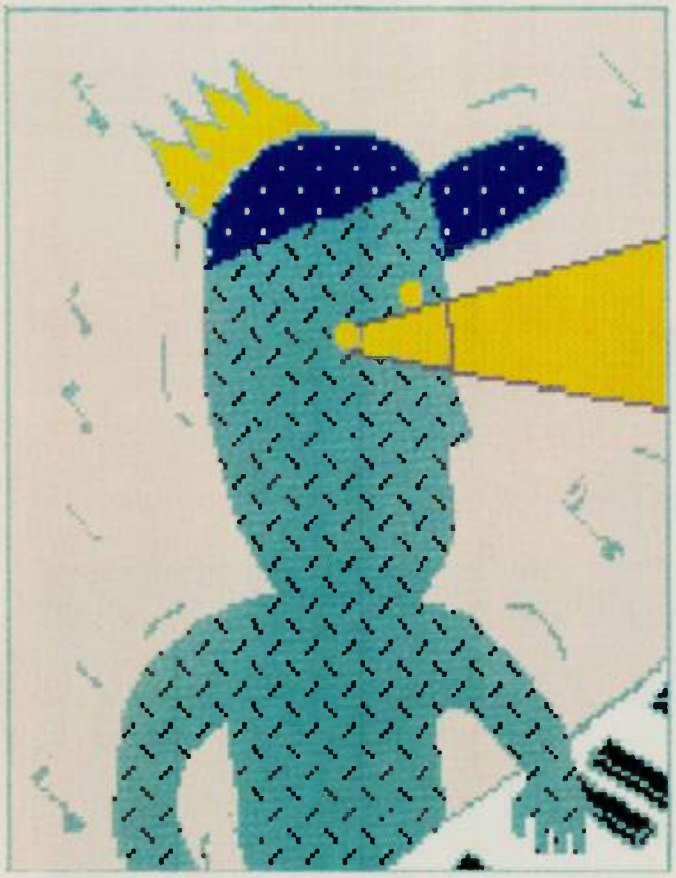
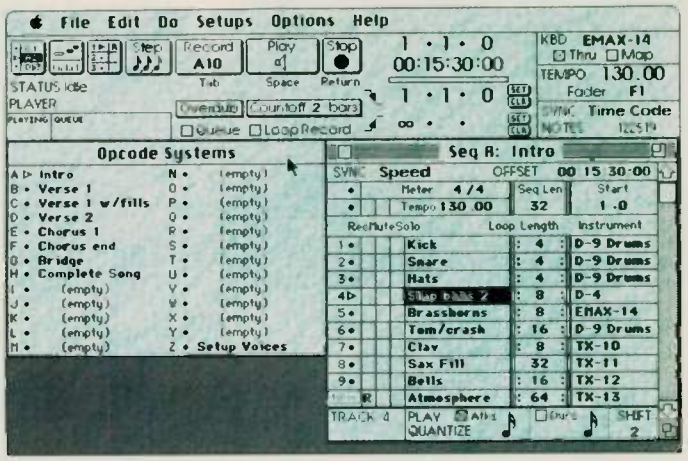


Vision

Ask any musician what they want in a sequencer, and the response will be the same—a system to fuel their creativity, to work with their ideas graphically, and to record or perform their music in real-time.

Opcode introduces Vision—a Macintosh sequencer so startling in its capabilities that you may never return to whatever tools you've used before.

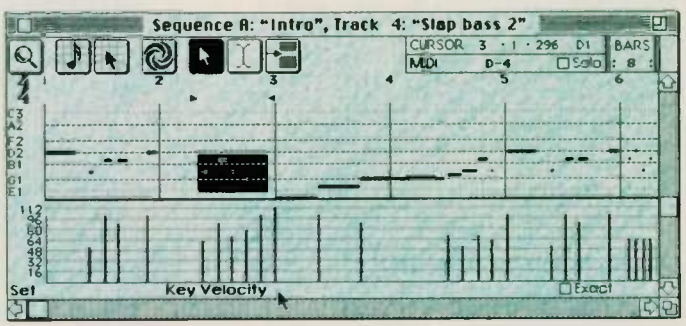
We built Vision from the ground up with the musician in mind. Instead of merely adding up a list of features, we've created an integrated system for composing and performing music.



Opcode's Vision is the most advanced sequencing program ever created for composing, recording and performing music. It even exports your work to transcription programs so you can print out musical notation. What else would you expect from the company that created the MIDI File format?

The first thing you'll love about Vision is the way it displays your work. In graphic editing, you can look at any part of your music—a single chord, the closing notes of a solo, a drum fill—you see them the way you hear them. Select any number of notes with your mouse and slide them back and forth in time, or up and down in pitch. Vision even plays the selection at a keystroke, so you can instantly hear whatever you're working on.

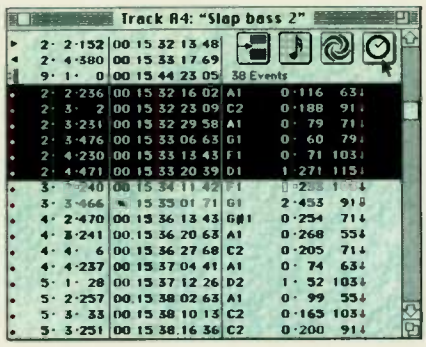
Then open the list editing window and your selection is already highlighted. Here, you use numbers to precisely change timing, pitch, note velocity or duration. And changes you make in one editing window are automatically reflected in the other.



Our graphic editing window displays more than just notes. A strip chart shows tempo, pitch bend or any other MIDI controller data. It even has a bouncing ball which follows as your sequence plays!

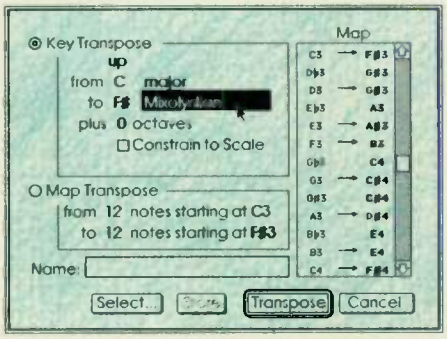
is Music to Your Eyes

And Vision's performance tools make it far more than just the ultimate recorder. Each file can contain up to 26 sequences from A to Z. That means no reloading, whether on stage or in the studio. Just type a letter and your music starts instantly. And you can play up to nine sequences at once. Or try generated sequences, where the computer gets to play too.

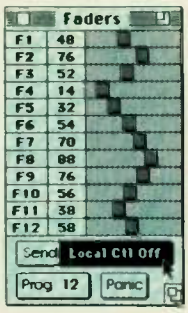


Our list editing window allows for precise manipulation of any MIDI parameter.

Now, of course, Vision has all of the features you would expect from the best sequencer on the market—multiple meter changes with an editable tempo track, 480 PPQ resolution, extensive quantization control, real-time track shift, SMPTE sync, sequence chaining, and record and playback of system exclusive data. It's fully loaded.



Vision's editable transposition maps can shift your music from any key to any other, even in real time.



But there are also abilities so revolutionary that they deserve special mention—like loop recording. Set the number of bars to loop, and continually layer music onto a track, storing only what you choose. Just like a drum machine.

Vision's 32 assignable faders make it a powerful MIDI control center. You can automate any MIDI controlled device, from mixing boards to lighting systems, even during playback.

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SECRETS of Dynamic Sequences

Sequence data, just like audio signals, can benefit from dynamics processing: compression, expansion, and limiting.

Limiters, compressors, and expanders are some of the most useful analog signal processing tools in music. It may come as a surprise, but most sequencers can create these same effects for sequenced data, with a precision that's definitely digital. What makes things even better is that sequencers aren't limited to just processing dynamics; they work with *any* MIDI controller data: pitch bend, modulation, breath, pedal, aftertouch, etc. ■ Processing the dynamic range of data has many applications, such as adapting the velocity values generated by one instrument to work with an instrument having a different velocity curve. For example, suppose you've worked out a great string part in your home studio, using an inexpensive synth, but rent an upscale sampler for the mix. Chances are the sampler won't respond to velocity the same way your synth does. If the sampler is more sensitive, notes might jump out of the mix; if the sampler is less sensitive, the dynamics will have a narrower range. A little compression or limiting can solve the first problem, while expansion can handle the second. ■ Limiting is perfect for taming loud, "rogue" notes that for whatever reason were recorded at a much higher velocity than other notes. Expansion/compression is particularly useful with controller 7 (MIDI master volume) data. I often like to control a synth's mix with a volume pedal, but

PHOTOGRAPH BY DAVID BISHOP

BY CRAIG ANDERTON

sometimes it turns out that as more overdubs are added, the volume variations are either too drastic (which requires some compression), or not drastic enough (generally solved by expansion).

Even pitch bend can benefit from dynamics processing. When I use a guitar controller, sometimes I want more vibrato than I can get from moving the string with my finger. Although it's possible to edit the guitar-driven synthesizer for greater sensitivity, expanding the sequence data itself lets me leave all my synths set for the same sensitivity, which makes life much less confusing in the long run.

To accomplish these feats, your sequencer must be able to process controller and velocity data in two different ways:

1. *Scale* the data, i.e., increase or decrease by a certain percentage.
2. *Add* or *subtract* a constant value for each piece of controller data.

Seeing this data displayed graphically can help you understand what's going on, but event list editing works just as well, if not better. The following examples were generated using Passport's *Master Tracks Pro 3.2*, but most other sequencers can accomplish the same results.

LIMITING

In audio, any signal you put into a limiter comes out with dynamic peaks no higher than a threshold you set on the limiter, regardless of their original levels. Signals below that threshold are untouched. This is a useful process with tape, radio, or any other medium with a restricted dynamic range, as audio peaks that exceed the available dynamic range will cause distortion. A limiter ensures that signals won't exceed that dynamic range.

This is the simplest type of processing to accomplish with sequencers, because no scaling is necessary. Let's assume you've played a melodic line, and it sounds great, except some of the notes are much louder than the rest. **Fig. 1** shows this velocity data (which, like most MIDI data, can attain a maximum value of 127); most levels range from around 80 to 100. However, the second note in measure two, the first note in measure three, and the fourth note in measure four have much higher velocity values, and they could stick out in a mix.

To tame these notes, first *add* a fixed amount to all note values. When this causes a note's value to exceed 127, it will be limited to 127, as no note can exceed this maximum value. Therefore, adding

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In general, this is a reasonably solid program. It offers more patch-generating functions than Dr. T, and clearer editing than Opcode. For auditioning, it offers sequence recording and playback plus a Keyboard window similar to Opcode's, with the addition of sending several types of controller data along with the triggered notes. The program's most innovative feature is called PatchSheet™, which shows all patch settings in a list that can be scrolled through for editing.

Excerpt of a review by Freff for **MacUser Magazine** February 1989

The Valhala D-50 Editor/Librarian is a full-featured voice editing and storage program for the Apple Macintosh. I have to say that the Valhala Editor Librarian is a very well constructed program. The manual is clear and the program is easy to learn. It does the job of editing and managing D-50 files very well and it is an outstanding value for only $129.00!

Excerpt of review by **Steve** Quinzi for **Music & Sound Output** September 1988

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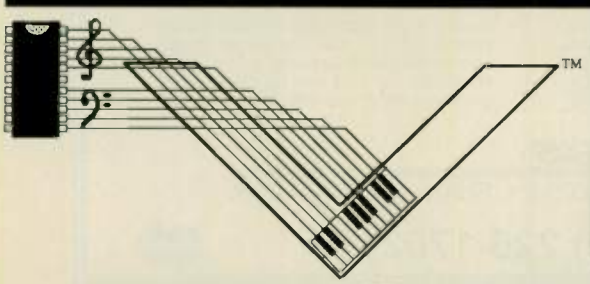

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this constant reduces the differential between the highest and lowest values. Second, *subtract* from all values the same amount you added, bringing the average level back to where it was originally. **Figs. 1** to **3** demonstrate how the process works.

1. Decide what you want the maximum velocity to be. In this case, let's assume you want no velocity values over 100.

2. Add a constant amount (k) to all data. Determine the amount to add from the following formula:

k = 127 - (maximum desired value)

In this case, we would add 27 (= 127-100) to all values. **Fig. 2** shows the results of adding 27 to all values.

3. Now subtract 27, the amount equal to what you added. **Fig. 3** shows the results: any notes higher than 100 are limited to that value, while notes at 100 or lower retain their previous values. Unlike regular audio limiting, this is "perfect" limiting that introduces no distortion and can be done with mathematical precision.

(A fine point: users of Master Tracks Pro might wonder how I managed to get a graphic display of velocity values, as this is not available within the program. I used controller data, as it can be readily displayed, but processing velocity works in exactly the same manner, even if you can't see the results graphically.)

COMPRESSION

Unlike limiting, which affects only the peaks of a signal by attenuating them, compression reduces the peaks and also amplifies lower-level signals. Again, this is easy to accomplish with most sequencing software.

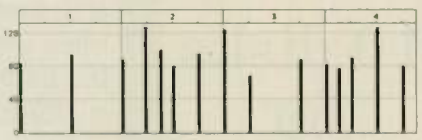

FIG. 1: Velocity values, as recorded.

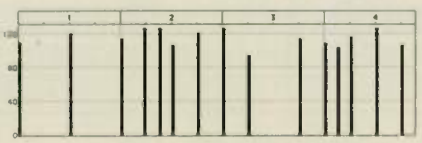

FIG. 2: +27 added to all velocity values.

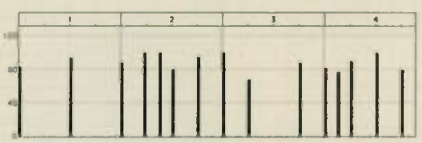

FIG. 3: Subtracting 27 from all velocity values restores the original dynamics except for the notes that were limited.

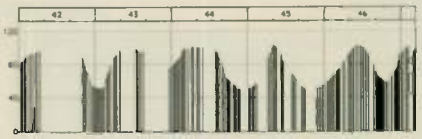

FIG. 4: Controller 7 data prior to compression.

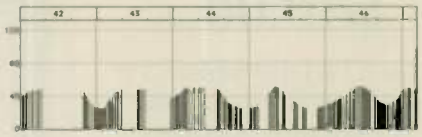

FIG. 5: Controller 7 data after scaling down by 50% (2:1 compression).

Fig. 4 shows controller 7 (master volume) data for a sequenced track. Let's assume the peaks and valleys are too extreme to fit in with the rest of a mix. This is a case for compression.

Begin by scaling all values downward, which reduces the differential between the highest and lowest levels. The amount of scaling sets the degree of compression (e.g., scaling all data down by 50% provides 2:1 compression).

Referring to **Fig. 4**, assume that the maximum controller 7 value is 100 and the minimum 50. There is a difference of 50 between the maximum and minimum values. Scaling all values down by 50% changes the maximum value to 50 and the minimum to 25, thus reducing the difference between the maximum and minimum values from 50 to 25 (2:1 compression). **Fig. 5** shows the results of 50% scaling.

Next, add a constant amount to the data to bring it back up to the desired overall average level. If you add 25 to all values, the soft parts will be the same level as before, but the loud parts will be softer. If you add 50 to all values (**Fig. 6**), the loud parts will be the same level as before, but the soft parts will be louder.

EXPANSION

Expansion is the opposite of compression: the loud parts get louder, and the soft parts get softer. Here's how to do it with a sequencer.

Fig. 7 shows an unexpanded, continuous controller signal (this could also be velocity or pitch bend). Determine the lowest controller value used, then subtract this amount from the entire signal. For

example, suppose the controller value varies between a high of 90 and a low of 50. Subtract 50, and the range extends from 0 to 40 (= 90 - 50) (**Fig. 8**).

Next, scale the range back up by multiplying the data by some amount. Scaling the example above by 200% doubles the range from 0-40 to 0-80, thus giving 2:1 expansion. Scaling by 300% (**Fig. 9**) triples the range from 0-40 to 0-120. Note, however, that if you scale so the highest velocity exceeds 127, the signal will start being limited by the available headroom.

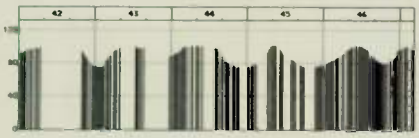

FIG. 6: Compressed controller 7 data after adding a constant to all values.

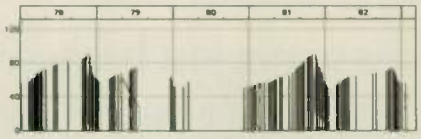

FIG. 7: Controller 7 data prior to expansion.

By following this procedure, the lowest controller value will be zero. Add a constant to this if you want a different lowest controller value.

Caution: when expanding, since the variation between each successive controller value will generally be greater than it was before, curves will not be as smooth. You may need to manually insert values between existing values (i.e., interpolate values) to smooth the response out a bit.

PROCESSING PRIORITIES

Always work on a copy of a track, because you may want to get your original back at some point. I'd also suggest doing any signal processing only *after* your tracks are recorded. The faster you work, the fewer the roadblocks to the creative process; you can always tweak things later. Besides, the character of a tune can change a lot during the recording process. You'll feel silly if you spend hours optimizing a track only to end up discarding the track later on.

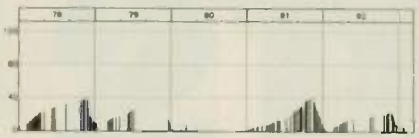

FIG. 8: Controller 7 data after subtracting a constant.

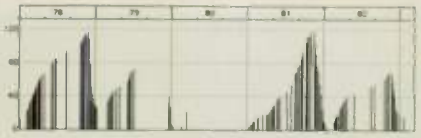

FIG. 9: Scaling up by 300% provides 3:1 expansion.

Have fun with these deceptively simple techniques. I hope you find them as useful as I have.

Craig Anderton *is the author of* The Complete Guide to the Alesis HR-16 and MMT-8, MIDI for Musicians, *and several other books. He lectures in the U.S. and Europe, produces and mixes albums, and is generally fascinated by anything that combines music and electronics.*

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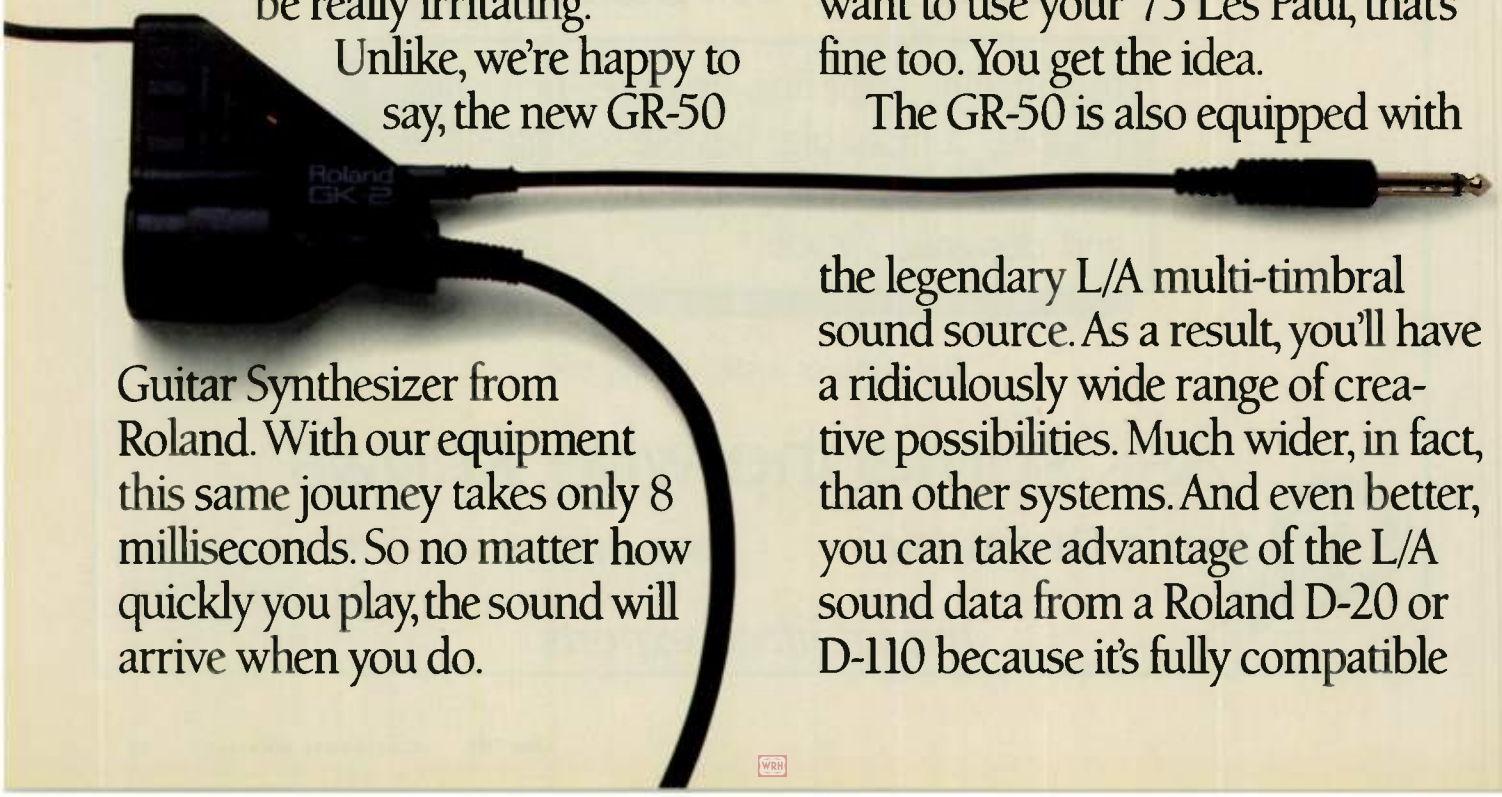

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A frequently heard complaint about sequenced music, particularly pop and dance-oriented music, is that it sounds computerized: mechanical, repetitive, and uninteresting. While this is often true, some simple techniques can make "machine music" sound more human. The computer, commonly viewed as the source of the problem, is an excellent tool for solving it. ■ If you listen to the minimalist compositions of Steve Reich, Philip Glass, or John Adams, the overall structure of the music at first sounds quite repetitive. Careful listening, however, reveals that the music's details change at least every few seconds. Rhythms and instrumentation get altered, and parts are added or dropped. Within the limits of the repetitive overall structure, the music *does* evolve. The repetitive structure draws me in, so I can be mesmerized by the details. To make sequenced music more interesting, you can create subtle variations in the notes or concentrate on the actual *sounds* of the synths. You'll need a sequencer with at least reasonable cut-and-paste functions and the ability to do individual note editing. As you might expect, I'm most familiar with Dr. T's *Keyboard Controlled Sequencer, Level II* (reviewed in the September '88 **EM**), so I'll be using it as a point of reference. However, most of these concepts can be easily translated to other sequencers.

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DON'T JUST LOOP THAT TWO-BAR PHRASE

Suppose a piece includes a two-bar part that you plan to loop for sixteen or 32 bars. Sequencers do this very well, but doing a straight cut-and-paste can create a boring, static line in the process.

Try copying the part, then "splicing" the copy onto the end of the original, creating a four-bar part. Then make some subtle changes to one half of the part and not the other: increase or decrease the velocity of a note or two, move a note ahead or behind by a few clock pulses, drop a note out of a hi-hat pattern, add or remove one voice from some occurrences of a chord, and so on. The idea is to create a four-bar part that sounds almost, but not quite, like a looped version of the original, two-bar part. Remember to keep the modifications subtle. Changes that are barely detectable when the part is played in isolation will add motion in context with the rest of the tracks.

Now, take the new four-bar part and repeat the process—copying, splicing, and changing half the part—again and again until your two-bar part has become a sixteen-bar part. It will have the same overall structure as the looped two-bar part but with subtle variations in the details that make it more interesting.

Another approach is to create a loop that slowly evolves. Let's say you have a sixteenth-note hi-hat or pitched percussion part. As the part progresses, slowly add accents, drop a note or two out for a while and put them back later, change one pitch, or *slightly* shift one note in time every now and then. You can also autocorrect the whole part to eighth notes, then shift some two- or four-bar sections ahead or back by five to 30 milliseconds. Another trick is to shift some of your tracks relative to the others, so all of the notes aren't sitting on the same time step. This is particularly effective for creating guitar and other strummed-instrument sounds in which the notes hit within a few milliseconds of each other. It's also helpful for adding a certain rhythmic feel to the piece. See the article on "The Feel Factor" (October '87 EM) for more ideas on how to use timing changes to humanize your music.

THE BIG PICTURE

Let's shift our attention from individual notes to the overall structure of a multitrack composition. Assume your piece has a relatively short rhythmic cycle, say four bars, and that other parts (solos, vocals, etc.) will be added after the rhythm parts have been completed. If your sequencer emulates the functions of a multitrack tape recorder, you can develop a relatively short passage, then use the sequencer to extend the structure of the piece beyond the original four bars.

Start by creating the short cycle with a large number of tracks, each consisting of a different part that could fit into that section of the piece. Listen to these tracks in different combinations, muting one, then another, to hear what you want. When you find a combination that works, use it for the first iteration of the passage. Mix and match in the same way to find another combination, and so on.

Record these tracks in real or step time, or copy existing parts, and apply either simple edit operations (see the looping section) or basic, bulk-editing operations such as pitch-transposition, rechannelization, or time-shifting. I also like to create tracks with the algorithmic composition capabilities of KCS Level II or algorithmic programs such as *M* or *Jam Factory*.

You can create a sense of evolution in your piece by starting with one group of

parts, then making small changes after each cycle, perhaps adding or dropping one or two parts or making some simple edits. You can develop a number of tracks on a relatively short passage, then chain different combinations of your tracks into a longer sequence or song.

HAS THE QUANTIZE MONSTER LOCKED UP YOUR MUSIC?

Another algorithmic technique addresses what I think are the biggest culprits in mechanical sequencer music: the quantize monster and its first cousin, step-time recording. A little bit of rhythmic variety can warm up those long lines of precise sixteenth, eighth, and quarter notes without changing the overall structure.

Some sequencer programs allow you to quantize a part, not just to eighths, sixteenths, and triplets, but to *any* series of time values. In KCS, for example, you can quantize your sequence to a "reference sequence" you create, so the notes of your sequence occur only when notes in the reference sequence occur. *Creator* and *Notator* for the ST offer similar template functions that are also exceptionally useful. This may sound a bit arcane, but a simple application of this feature is to put a swing feel in a sequence. (*The simplest way to give a line a little swing is to make the eighth notes on the "down" beat last a little longer than those on the "up."—Ed.*) At 24 steps/beat, eighth notes consist of twelve steps. Auto-correct your line to a sequence that contains just one 13-step note and one 11-step note. The first eighth note in each pair of your line will now be two steps (about 40 milliseconds at 120 bpm) longer than the second in the pair. The smaller the differential between notes, the more subtle the feel.

In isolation, shifting one note in a pair

ALGORITHMIC EDITING WITH PVG

Some sequencer programs provide "algorithmic" editing features that work according to some set of rules or procedures. I primarily use the *Programmable Variations Generator* (PVG) module in *KCS Level II*, but several other programs, including the *Commodore 128 KCS*, *Performer* and *Total Music* on the Mac, Steinberg's *Pro 24* on the ST, and *Cakewalk* on the IBM also include algorithmic features. In addition, *Master Tracks Pro* includes a humanize feature that allows for randomization of velocity, duration, and start time by a specifiable number of clock pulses or values. Using large, clock-pulse shifts (i.e., hundreds or even thousands of clock-pulse shifts), then requantizing, can totally rearrange the notes within a piece.

Algorithmic editing in the PVG selects notes from a sequence and processes them depending on a variety of criteria—absolute pitch, scale position, position in a bar, and so on—and does so for part, or all, of a track. The PVG will not only change one note to another, but will let you spice the part by erasing notes, adding accents, changing pitch, and making other modifications. Even if you want the same pitches to repeat exactly, accenting a downbeat, for example, can help make a kick-drum part sound more human, and altering the duration and start time of arpeggiated notes opens up the sound quite a bit. The other programs mentioned above offer their own ways to massage data, which can be equally effective in adding subtle, and sometimes not-so-subtle, variations to your music.

Perhaps my favorite PVG feature allows you to attach a short phrase to notes (selected as before: all notes, those defined by the criteria above, or random notes), which will play when those notes occur. This "ornament" can also follow the pitch and velocity of the note to which it is attached. You can enter the ornament phrase from the computer keyboard or copy it from a phrase recorded in real time. The simplest application of this feature is to create echoes: you can have a note repeat until the next one sounds.

Another simple application is to apply a percussive ornament consisting of some additional sound that will beef up the attack on a bass line, accenting notes that fall on "important" scale positions or that were played with relatively high velocities. With enough practice, you can use ornaments to build a complex and interesting rhythm chart out of a single bass line.

—ET

by 20 milliseconds will be barely perceptible, and a smaller shift will be very difficult to hear at all. However, when combined with other parts that have been quantized differently, shifts as small as five milliseconds can be heard clearly, and smaller shifts can have real, though more subliminal, effects. Remember that it takes MIDI at least 2/3 ms to turn a note on (a millisecond if the channel has changed) and another 2/3 ms to turn the note off. Also, your instruments may have their own timing inaccuracies, which should be taken into account.

THE OUTER LIMITS

For an even more complex effect, create a one-, two-, or four-bar reference sequence, mixing even eighth notes and ones with varying amounts of swing. You can make the feel of a longer part evolve by quantizing the first four bars to this reference, then changing the reference slightly and quantizing the next four bars, and so on. You can also quantize *part* of every few bars to eighth notes and the rest to sixteenths, triplets, or not at all. (In KCS, you can add accents to specific places in the rhythm pattern, select notes that fit a pitch pattern defined by user-specified rules, and have the program process all the notes that meet the criteria or select notes at random for processing.)

You can tame the quantization monster by editing individual notes manually.

A simple technique with a bass line or pitched percussion part is to accent notes that fall on certain scale positions. You can select these by whim or according to their importance in the overall melodic and harmonic scheme of the piece, accenting, for instance, the first note of a new chord change. Accent the notes by either scaling their velocities up or setting them to a high, fixed value; process all, or some, of the notes that fit your criteria. Have the part evolve by accenting certain notes for four bars, then a different set for the next four, and so on. As with rhythmic processing, even very small accents will vary the feel of the piece, if the accented notes are changed every few bars.

Again referring to KCS, the Programmable Variations Generator module lets you select notes by position: for example, those that fall on the first beat of each bar or the last bar of each four-bar cycle. Use this with a hi-hat part to erase some or all of the notes on, for example, the fifth eighth note of each bar. You can also rechannelize selected notes this way, assigning them to an instrument with a slightly different timbre for subtle effects or a *radically* different timbre for contrast. On a drum part, try reassigning certain hits to a different drum sound by changing their MIDI pitch values.

Notator and Creator allow for similar, automated quantization changes, but even if you don't have a sequencer that allows for these kinds of tricks, there are plenty of ways to tame the quantize monster by editing individual notes manually. If you have a fairly short looping pattern, enter the required time values by hand,

and add a few accents by raising occasional velocity values. Alternatively, change a note's pitch interval or time relationship relative to the next, or preceding, note.

CHANGING THE PROGRAM

MIDI's power as a tool for creating computer- and sequencer-based music comes largely from the plastic nature of MIDI information. A sequencer doesn't store sounds, but messages (note ons and offs, pitch bend, etc.) that describe different aspects of the sounds the instruments make. Because of this, we can address, separately, different aspects of music that normally must be created simultaneously on acoustic instruments. This gives us a great potential to modify the final sound.

Let's go back to one of our two-bar phrases that loops for sixteen bars. Create a group of similar sounds for the synthesizer playing this part. The differences between sounds can be quite subtle: perhaps a slight difference in the attack or decay phase of an envelope, the levels of one or two operators on an FM instrument, or the waveform of a single oscillator on an ESQ-1 or TX81Z. On a separate track, overdub MIDI program change commands in real time to change the synth sounds as the sequence plays. Edit them to occur at regular intervals—for example, every two bars—or to go from a fairly dull to a progressively brighter or "edgier" version, then perhaps back to the original. There may be some glitching when you change programs, so make sure any program change commands always occur during a silent part of the music.

A little bit of rhythmic variety can warm up those long lines of precise notes.

One of the reasons for creating *Multi-Programming Environment* (MPE) in Version 1.6 and Level II of KCS was to help in setting up different patches. On the Amiga or ST, you can run patch editors simultaneously with KCS and play a sequence from the program-editing screen, developing different sounds while you hear the sequence. (*As another example, Macintosh fans can do the same sort of tricks with the Zero One Research* D-50 Editor *desk accessory, which also lets you tweak sounds while your sequencer is running. The recently introduced M.ROS operating system, from Steinberg/Jones, for the Atari, Mac, and IBM is optimized for these types of multitasking applications.—Ed.*)

CREATIVE VELOCITY

Many sounds use velocity to control volume or the filter envelope. On FM instruments, velocity can be used to control several operators by approximately the same amount to add volume or brightness. These techniques are useful but aren't all you can do with velocity.

For example, with an FM instrument, try putting an operator completely under velocity control. If you set the operator to add a whole new set of harmonics or some edgy, enharmonic sound (one way to do this is to give the operator's envelope a different shape from other envelopes), the velocity changes will liven up the tim-

bres considerably. Another trick is to use velocity to mix in an oscillator with a wave shape radically different from the sound's basic wave, or speed up the attack of a critical envelope, fade between one oscillator and another, bend the pitch of one oscillator and not the others, etc. The Oberheim Matrix series of synths is especially useful here, since they let you control almost any parameter with velocity: oscillator mix, waveshapes, envelope decay and release times, and more.

THOSE MYSTERIOUS CONTINUOUS CONTROLLERS

One major reason synthesized music sounds unexpressive is that many musicians ignore some of the most important (and readily available) expressive tools. Many factory presets don't use footpedals, aftertouch, breath, or other external controllers, and mod wheels typically limit themselves to adding a fixed frequency vibrato. Most synths and keyboard controllers I see don't even *have* footpedals attached to them. Further, musicians often fail to use the tools at hand to vary the timbre of a sound from note to note or change the sound of a sustaining note.

To understand why using these controllers is so important, consider the factors that influence the sound of an acoustic instrument: the angle and position at which the string is plucked, the speed and pressure of the bow, the precise way the saxophonist blows. The playing process is intimately connected to the creation of the sound and directly affects the instrument's timbre, and the good player varies these parameters from note to note to make the music sound more expressive. The *synthesist* can be more expressive by programming patches in which timbre, as well as pitch, responds to changes from external controllers.

Let's look at some specifics. FM instruments such as the TX7 and TX81Z have only one tool for this particular type of control: EG bias. This can modify the output level of any or all of the operators, either at a note's attack or during its sustain. EG bias programming is similar to velocity programming, and the hints I've given above about velocity programming apply here as well. On the DX7 or TX7, EG bias can be controlled by a wheel, pedal, breath controller, or aftertouch, while on a TX81Z, it can be controlled only by breath and aftertouch. In addition to MIDI guitars that can generate breath control and wind controllers such as the Yamaha WX7 and the Akai EWI, a number of keyboard controllers can convert wheel or pedal data to breath controller data, if necessary.

One major reason synthesized music sounds unexpressive is that many musicians ignore some of the most important (and readily available) expressive tools.

There are many ways to use continuous controllers. One of my favorite "instruments" involves setting two TX7s to the same MIDI channel, then programming one to respond to EG bias from a footpedal and the other to respond to breath. When you create and edit "stacked" sounds like this, edit both together, thinking of them as belonging to one instrument producing a single sound. Admittedly, this takes some time and effort, but in my case this was rewarded by a set of sounds so rich and expressive that I didn't feel the need to change them for three months.

Some instruments, such as recent products from Ensoniq and the Matrix series (as well as the "old favorite" Oberheim Xpander), have a much larger set of possibilities, allowing the mod wheel, the footpedal, and a "wild card" external controller to control velocity and allowing velocity to control almost any parameter. In addition to the controller-to-parameter assignments mentioned above, I also like controlling the depth of the LFO, bending the pitch of one of the oscillators relative to the others, and mixing waveshape or oscillator volumes.

THOSE FINAL OVERDUBS

Once you've programmed your synths to respond to controllers, consider how you want to use them. If you're recording in real time, you can play the controllers while you play the notes. If you're entering the part in step time or creating it with some of the sequencer-editing tricks I've mentioned, you can again take advantage of the plastic nature of MIDI and add the controller data later. All you do is create a new track, and while you listen to the music, use wheels, levers, pedals, or whatever device you favor to record the controller data on the new track. (Master Tracks Pro *has an excellent feature for this kind of recording: using a mouse, you can draw the slope of any controller in any shape you like and apply it to your synth.— Ed.*)

Overdubbing controllers is yet another way to add expression to those two-bar loops we've talked about. You can play the part, in context, and overdub the controllers improvisationally as you respond to the music as a whole. You can also plan a timbral evolution for the part, perhaps starting at one setting, then slowly moving to another, then having a period of rapid changes before fading back to the original.

If you overdub a lot of controller data, you may find yourself running short of memory or discover some timing inaccuracies caused by "clogging" of the MIDI data line. Both of these problems can be solved if your sequencer can thin out a stream of controller values. I have found that two-thirds of the controller events recorded in real time can usually be removed without a noticeable change in the sound of the piece.

I never consider a sequenced piece completely finished until I have overdubbed controller tracks for all instruments that can respond to them or (more rarely) have made a conscious decision that certain parts are better off without controller overdubs.

SOME FINAL THOUGHTS

It seems that with MIDI sequencing, editing is as important a function as playing the part in the first place. With traditional tape recording, one often spends hours playing a part over and over to get things "just right." With sequencing, the first time you play a part might be the last. Your efforts will go into editing a part rather than repeatedly playing it. Modern-day sequencers and synthesizers offer a wide variety of tools that let you humanize your music. Don't stop editing until your music is all it can be.

Emile Tobenfeld *(Dr. T) received a Ph.D. in physics from Cornell University in 1971. He has been creating music with synthesizers since 1976, although he has neither formal musical training nor "chops" on any conventional instrument. He founded Dr. T's Music Software in 1984.*

From the series "Instruments at an Exposition" by Davey Johnstone

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MAY 12-14

A Buyer's Guide to DAT Reco

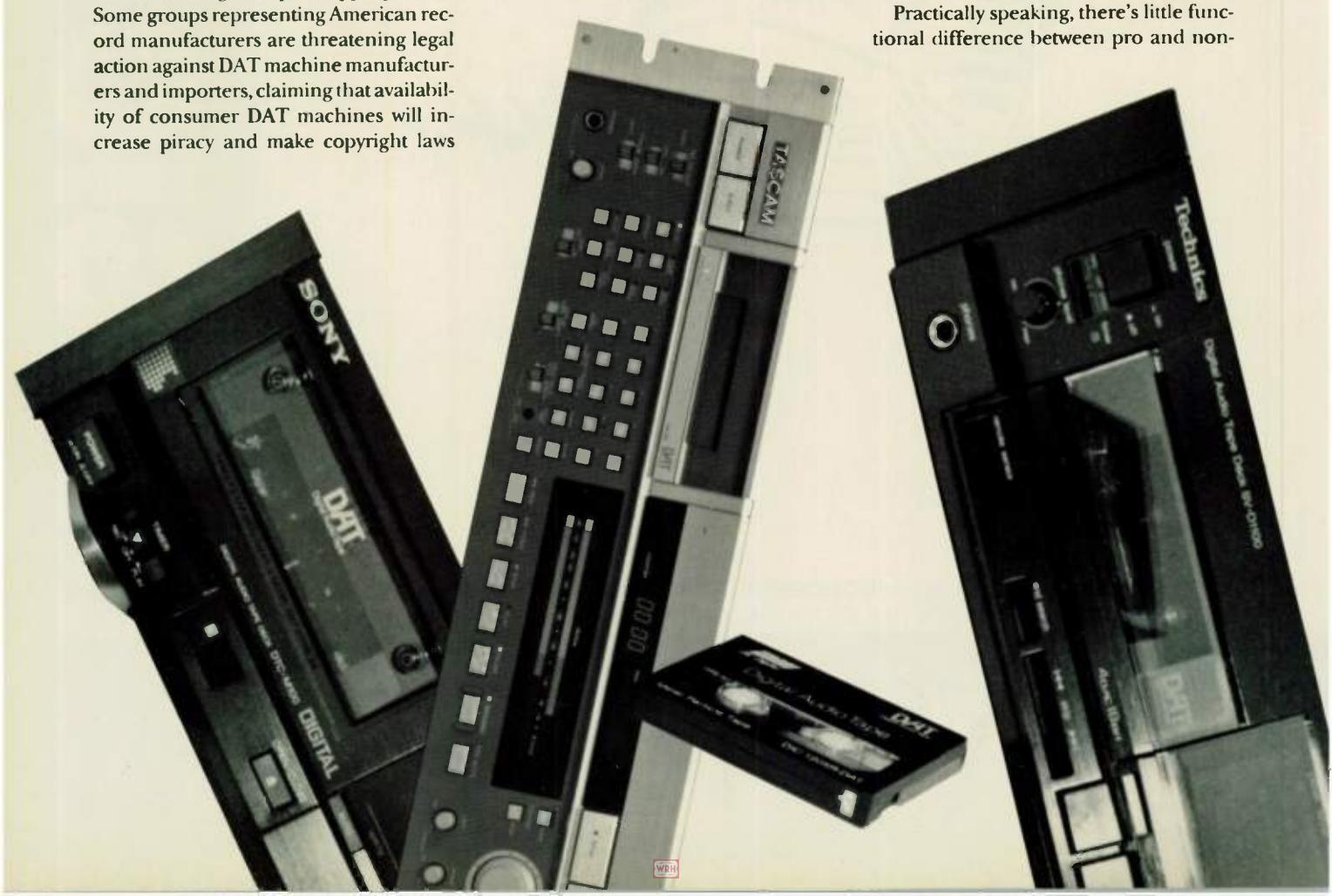
When it comes to a cost-effective mastering deck, it's hard to beat DAT recorders. Here's a buyer's guide to current models, with helpful tips on purchasing.

LAST MONTH, EM looked at the technical and theoretical side of Digital Audio Tape (DAT) recorders and talked about some of the things you may want to consider before you use this technology in the studio. This month, we're going to cover the marketplace specifics: what's out there, what it does, and how you get it.

Before we examine the current state of available DAT hardware, let's take a brief look at the digital tape-shopping scene. Some groups representing American record manufacturers are threatening legal action against DAT machine manufacturers and importers, claiming that availability of consumer DAT machines will increase piracy and make copyright laws essentially unenforceable. As a result, consumer hi-fi DAT components are *not* officially imported into, or distributed in, the United States; the Japanese biggies (Sony, Technics/Panasonic, JVC, et al) are waiting for the U.S. political climate regarding digital taping to cool off. In the absence of these imports, a thriving "gray market" in consumer DAT hardware—which *is* officially sold in Japan, West Germany, France, and elsewhere—has sprung up.

Meanwhile, DAT manufacturers have commenced selling "pro" recorders in America. These are split between genuinely professional machines (with balanced inputs and outputs, time code provisions, and other serious studio features) and thinly disguised home units that have been assigned a new model number and had "Pro" screened on the front panel.

Practically speaking, there's little functional difference between pro and non-



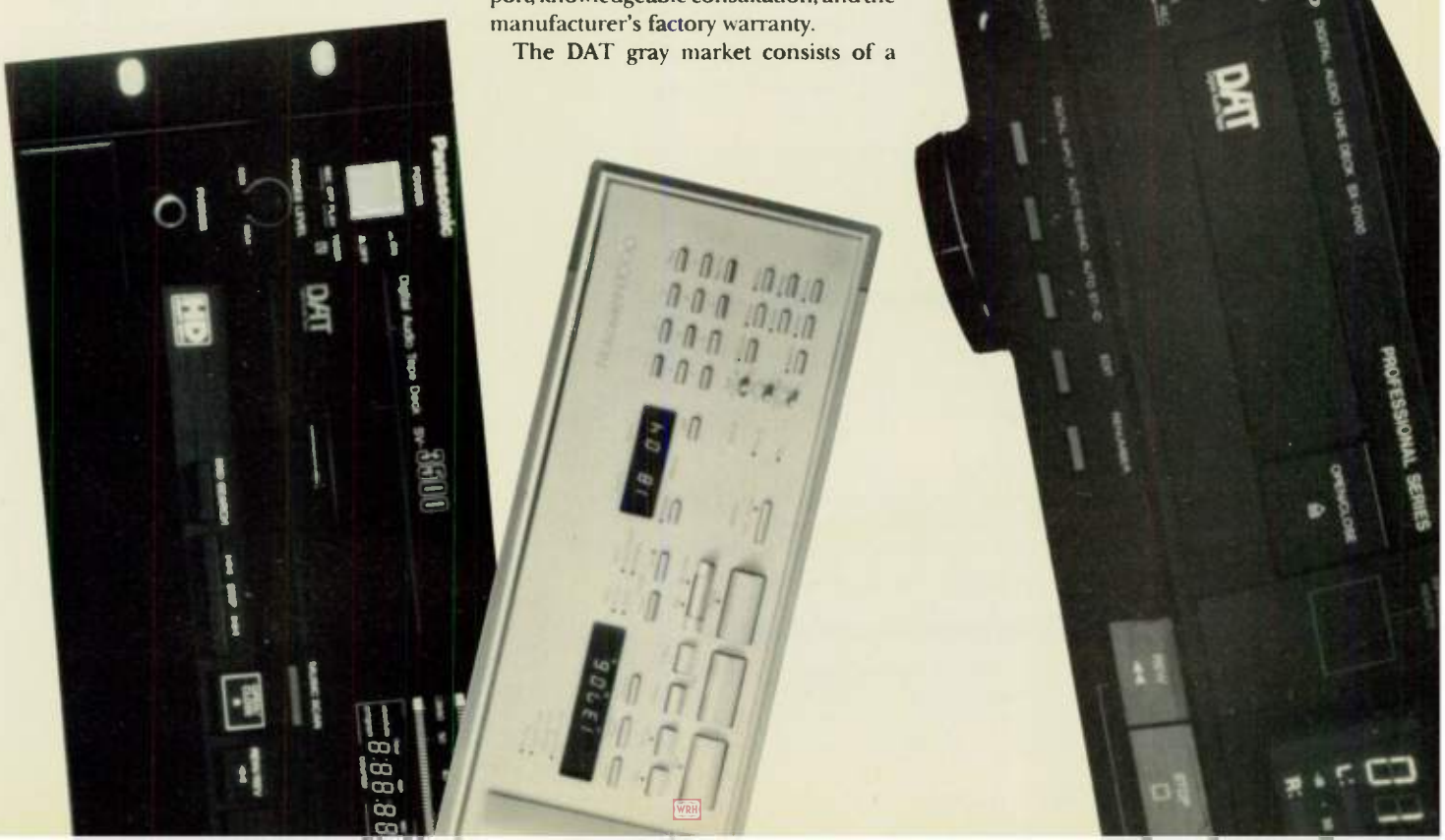
rders

BY DANIEL KUMIN

pro designs except the all-important presence or absence of the 44.1 kHz sampling frequency. All DAT decks offer 44.1 kHz sampling for *playback* in order to play pre-recorded DAT tapes. But to copy CDs in the digital domain, the deck must also *record* at 44.1 kHz. Fully "pro" designs have this capability; "home" units do not. (As an added problem, many—perhaps most—CDs incorporate a digital copy-inhibit bit in their subcodes, which will prevent any DAT deck from digitally recording them, regardless of the deck's capabilities.) More important, if your recording will ultimately go onto a CD, you want to master at 44.1 kHz so the entire CD mastering process can take place in the digital domain. If you record at the 48 kHz rate that many DATs allow, and want to stay all-digital, your tape will have to be submitted for expensive sampling rate conversion to 44.1 kHz.

Once you've made the pro/home choice, the question of where to buy remains, because some pro machines are also sold by gray-marketers. Officially, professional DAT units are mostly sold through the first rank of large, studio-oriented, pro audio distributors, so generally you'll pay top dollar. For your money, you'll get factory service and support, knowledgeable consultation, and the manufacturer's factory warranty.

The DAT gray market consists of a handful of importers who specialize in off-shore audio products and several high-end audio shops that have begun bringing in their own DAT supplies. A non-U.S. home DAT deck from the gray market will quite possibly have an attractive price but will probably be a Japanese model, and its power supply will be set for 100 volts. This may or may not be adjustable to work on the 117 VAC American standard, so make sure that your unit



● DAT

either is appropriately modified or includes an outboard step-down device.

Usually, a warranty will be offered by the gray-market vendor, probably equal to the manufacturer's in term, but without factory support and only as effective as the seller cares to make it. You also risk missing out on any upgrades or technical bulletins regarding your model.

It's a tough choice. Keep in mind that while DAT technology is sure to undergo improvements, these should be incremental rather than revolutionary. Also remember that a DAT unit is at least as complex and tricky to repair as your multitrack machine.

Oddly enough, DAT cassettes are widely (and officially) available. DAT comes in 120-, 90-, 60-, and 46-minute lengths (at 48 kHz recording). Almost all the major tape houses—Sony, TDK, Maxell, BASF, Fuji—sell DAT. Most pro suppliers stock it, as do all the gray-market DAT specialists, and some high-end hi-fi shops are bringing DAT cassettes into their stores. A 120-minute DAT should run about $14 to $16 and a 46-minute tape about half that.

WHICH DAT?

The following scan of currently or soon-to-be available DAT hardware—both pro and home—is by no means encyclopedic, but is a representative sample of accessible models. Keep in mind that many of the units described are only available through the gray market. Prices can change quickly (*We saw differences as great as $300 on the same model.—Ed.*), and the models you find may differ somewhat from what we've described here.

Aiwa

This Sony subsidiary sells several machines in Japan. The XD-001 was one of the first units gray-marketed in this country. It is substantially the same as the Sony DTC-1000ES and may still be found at around $1,600.

Akai

Akai's D-9000 is a home hi-fi DAT deck with both optical and coax electrical digital I/O, extensive track programming, and search features. Signal-to-noise ratio (S/N) is quoted as 92 dB. Typical gray-market pricing will be around $2,200. Another model, the D-930, may also be found for several hundred dollars less.

Casio

The "everything company" takes honors (so far) for the world's smallest DAT unit.

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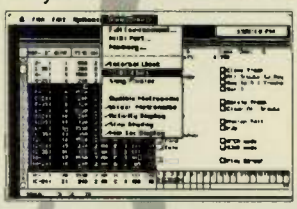
NEW V1.7

Everything about KCS and Level II is dedicated to making your musical experience as rewarding as possible.

Fast screen update. Easy recording. Instant playback. Total editing. And composition tools you thought were unavailable on personal computers. These are the most powerful sequencing environments available on any computer.

KCS has been the standard by which all other sequencers have been judged. With essentially the same features on the Atari ST, Amiga, and Macintosh (Level II only), the flexibility of being able to use the same program, and the same data files, on three different computers is unprecedented.

Level II has been hailed by critics and users as *"the most comprehensive composition environment ever created."* Containing all of the features of KCS, it enables you to find new methods of creating music that will free your imagination. With both random and fully determined methods of creating variations on your themes, you will find just how much of a partner your computer can be in your creative process.



On the Atari ST, our exclusive Multi Program Environment and GEM compatibility give you the power of an integrated digital workstation. With over 20 MPE modules available, you can configure a system to suit your personal taste and budget. And on the Amiga you get total multi-tasking capability with any standard application from music to databases. KCS and Level II ST contains the MPE. Level II requires at least 1meg of memory on any computer.

KCS or Level II, all the sequencer you will ever need.

KCS Features
48 tracks
126 sequences
16 songs
Auto-Looping
Record/overdub
Mouse-operated controls
Controller input filters
Merge
Echo/Rechannelize
Solo
Mute
Quantize
Record while cueing
Punch-In/Out
Real-time Track Shift
SMPTE sync: Phantom
MIDI Song Pointer
Edit all MIDI parameters
Range highlight editing
Transpose
Invert
Quantize
Time-reverse
Velocity-scaling
Cut/Copy Paste/Erase/Delete
Spilt or erase controllers
Change time signatures
Program tempo changes
Pop-up timing calculator
Step-time recording
Easy Song Mode
Open Mode for total control
Scratch pad for comments
Record sys-ex dumps
Supports MIDI files
Stores preference files
190 page indexed manual

LEVEL II Features
PVG
Generate variations on previously recorded parts;
Produce changes in pitch, dynamics, controller values, rhythm and expression;
Produce single variation or create a series of variations that evolve over time;
Variations can contain some randomness or be fully determined;
Create trills and ornaments to notes in an existing sequence;
20 editable Macros for still more complex edit operations;
Save 80 "Presets" to disk
Master Editor
Edit based on:
pitch
velocity
interval from a note
position in pattern;
Re-map pitch(es) in any track or sequence;
Auto-correct to a time grid;
Match rhythms or pitches to any track or sequence;
Chords can be deflammed, sorted, arpeggiated, or orchestrated;
Extensive pattern matching;
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• DAT

Casio's DA-2 portable DAT recorder is 9.5 × 5.8 × 1.75 inches and weighs just 2.8 pounds with battery pack. The design provides 48 and 44.1 kHz sampling rates for playback but only 48 kHz for recording. Programming, track search, and skip features are also available. The DA-2 includes analog, RCA-type ins and outs, a headphone mini-jack, and unbalanced, phone-jack mic inputs, but no digital I/O. A two-hour battery pack and charger are included. Specs quoted for the Casio design include a 10 Hz to 20 kHz frequency response (±1 dB) and an 85 dB dynamic range. The DA-2 will be available in June at Casio's authorized musical instrument dealers. Its suggested retail price will be a relatively low $1,499.

Fostex

From the people who popularized ¼-inch, 8-track recording comes another unusual, innovative tape recorder. The D-20 Digital Master Recorder is substantially different from most other DAT designs. First, it includes a slightly modified four-head configuration, allowing direct, off-tape monitoring (like professional analog decks) as well as precise, punch-in/out editing. The D-20 can also record SMPTE/EBU time code (utilizing the DAT format's extra subcode capacity) before, during, or after music recording. Not surprisingly, the unit includes a Fostex-standard, 20-pin, synchronizer port. A ±10% pitch control for record or playback is also part of the D-20's design. In spite of its somewhat unorthodox head and track configuration, Fostex maintains D-20 tapes will play back on any DAT deck.

Sony TCD-D10

The D-20 employs two-times oversampling filters both for A/D and D/A conversion. It provides AES/EBU digital I/O (but no optical digital ports); balanced, XLR-type, pro line-level, analog inputs and outputs; and XLR time code ins and outs. The recorder also offers several external sync ports for film and video configurations and a DB-9 serial port. The D-20 writes digital copy-guard, records and plays back at 48 and 44.1 kHz sampling frequencies, and provides switchable emphasis and error/corrections indication. Stated specs for the D-20 include: 20 Hz to 20 kHz frequency response, a dynamic range greater than 90 dB, and THD less than 0.05%. Fostex sells the D-20 through its professional "E-Series" dealers on a special-order basis. The D-20's suggested price is $8,000.

JVC

At least two JVC (Victor) machines have appeared in the U.S. gray market. The XDZ-1100 is a home deck with—somewhat unusually—fully implemented 32 kHz, half-speed recording (for longer-play, lower-fi applications), and optical and electrical digital I/O. There have been reports that this machine can be easily modified to record at the 44.1 kHz sampling rate. It sells on the gray market

for somewhere between $2,000 and $2,500. A less expensive unit, the XDE-900, offers generally similar features for about $500 less.

Sony PCM-2000

Nakamichi

Cassette recorder specialist Nakamichi is making big noise in the DAT world with the introduction of its Nakamichi 1000 Digital Audio Recording System, which is loaded with innovative technology. Perhaps most significant, it both records and plays back at all three sampling rates: 48, 44.1, and 32 kHz. The recorder employs a proprietary, four-head design that permits true off-the-tape monitoring. Nakamichi designed a new DAT transport for the 1000 that permits tape shuttling at twice the normal fast-wind speed. The transport also is said to improve tape travel precision for lower error rates, cut down tape-loading time, and reduce stress on the tape itself.

The 1000's design employs a unique, 20-bit D/A conversion scheme: two 16-bit D/As are used per channel, in a 20-bit configuration. The converters are individually trimmed, with each Nakamichi 1000's correction values loaded to an individually "burned" ROM chip. Nakamichi claims unmatched conversion accuracy for this system. Nakamichi exploits a new A/D chip said to eliminate the need for a conventional sample-and-hold circuit. Each time a Nakamichi 1000 is switched on, its A/D converter auto-calibrates, correcting for the chip's inherent quantization errors.

The 1000 is a two-box design, with the DAT transport and controls in one chassis and the conversion electronics and preamp controls in the other. It includes balanced (XLR) and unbalanced (RCA), analog line inputs and outputs; three pairs of digital inputs (coax, electrical, and optical); and two pairs of digital outputs. A single converter unit can control multiple transports for professional dubbing systems. Inside, Nakamichi's DAT is fully modular, with all important circuits carried by plug-in boards. This creates an upgrade path as technology advances or as third-party tweakers develop.

Both a professional and a consumer model of the 1000 will be available. The only differences are that the pro version has a rack-mount chassis and pro levels/impedances on its balanced, analog ins and outs. The unit's specs include 2 Hz to 22 kHz response, greater than 94 dB dynamic range, and less than 0.003% THD. The Nakamichi 1000 is distributed through authorized Nakamichi dealers at a suggested price of $10,000.

Panasonic Professional

The Panasonic Professional Audio Group (the same people who sell Ramsa products) is officially selling two DAT decks in the U.S., one portable and one studio model. The SV-250 pro portable is one of the niftier DAT packages available: it measures 8.5 × 4.75 × 1.75 inches, weighs 3.2 pounds, and includes a rechargeable battery pack, battery charger, and carrying case. It incorporates an A/D stage that uses multistage noise-shaping (MASH) technology, developed by Japan's NTT telephone company, to perform a type of 64-times oversampling, digital input-filtering. While not directly comparable to "normal" oversampling, the MASH scheme yields improved small-signal accuracy, and the SV-250 has acquired a reputation for good sound quality. The unit provides balanced XLR mic/line inputs and mic preamps equipped with switchable pads and limiters. It records at 48 kHz only; playback is 48 or 44.1 kHz. Line outs are unbalanced RCA type. A digital output is included (unusually, a mini-pin jack, with supplied cable), as are a headphone amp and jack. There is no digital input.

The SV-250 furnishes the usual complement of track-access and programming features and a comprehensive LCD with 55 dB bar meters. Its basic specs include 10 Hz to 22 kHz response (+0.5, -1 dB), greater than 87 dB dynamic range, and THD less than 0.05%. Panasonic's suggested price for the SV-250 is $3,900.

Panasonic's SV-3500 is a rack-mount studio deck with professional features such as balanced XLR (pro levels and impedance) analog line input/output, coax digital I/O, and wired remote control. Sampling frequencies are 48 or 44.1 kHz record and playback; 44.1 kHz recording is done via a switch near the analog inputs. There are no mic preamps. The unit employs a different A/D scheme from the SV-250, with dual (left and right), 18-bit A/D converters for improved low-level conversion linearity. The D/A section uses four D/A chips, with 2-bit shifting for "quasi" 18-bit performance; there are two chips per channel, in a push-pull configuration said to reduce distortion and provide 18-bit playback resolution. The SV-3500 is equipped with complete track ID, programming, and search facilities and flexible, high-speed, audible scanning. Specs are 10 Hz to 22 kHz (±0.5 dB), 90+ dB dynamic range, and THD below 0.05%. Panasonic's suggested price for the unit is $2,950.

Both Panasonic units are sold through Panasonic Professional Audio (Ramsa) dealers. Because gray-market versions are

DAT'S NOT ALL

Change is constant in the DAT world, and many new DAT machines are in the works. It is hard to know what will actually reach the U.S. market, but our sources tell us to watch for the following, mostly gray-market, machines:

Sony is expected to release the DATman, a Walkman-size, playback-only machine. Anticipated gray-market price: approximately $599. Also from Sony: a Japanese version of the TCD-D10 Pro, called the TCD-D15; a redesigned DTC-500ES (so new we could-n't get details); the DTC-2000ES, a new version of the DTC-1000ES; and two other models, the DTC-M300 and the DTC-400, details unknown.

JVC is expected to replace the XDE-900 with the Z-700 and the XDZ-1100 with the Z-900. The Z-900 has 18-bit technology and an optional four-hour recording time, albeit with a reduced frequency response.

Aiwa is replacing the AD-999 with the XD-001. Pioneer is expected to introduce the D900, which will be very similar to the Sony DTC-1000ES. Yamaha is said to be preparing the DX2000R, and Denon is supposedly working on the DDRM-200, but these are too new for us to get substantive details.

Thanks to Kevin McEvoy of American International Audio/Video for helping with up-to-date information.

—Steve Oppenheimer

not UL-listed, it is a Panasonic policy not to repair them.

Sharp

A Sharp DAT deck, the SX-D100, is being marketed by Sharp U.S. as a professional unit but can be found at gray market sources as well. The unit provides consumer-format line inputs and outputs and coax, electrical, digital I/O. There are also optical ins and outs that do not use the (de facto) standard Toshiba connector.

The Sharp records at 48 kHz only; playback is at 48 or 44.1 kHz. Program and search functions are included, as is a wireless remote. Specs are 5 Hz to 22 kHz frequency response (±0.5 dB), 90 dB dynamic range, and claimed THD of 0.005% at 1 kHz. The Sharp unit's suggested price is $2,700.

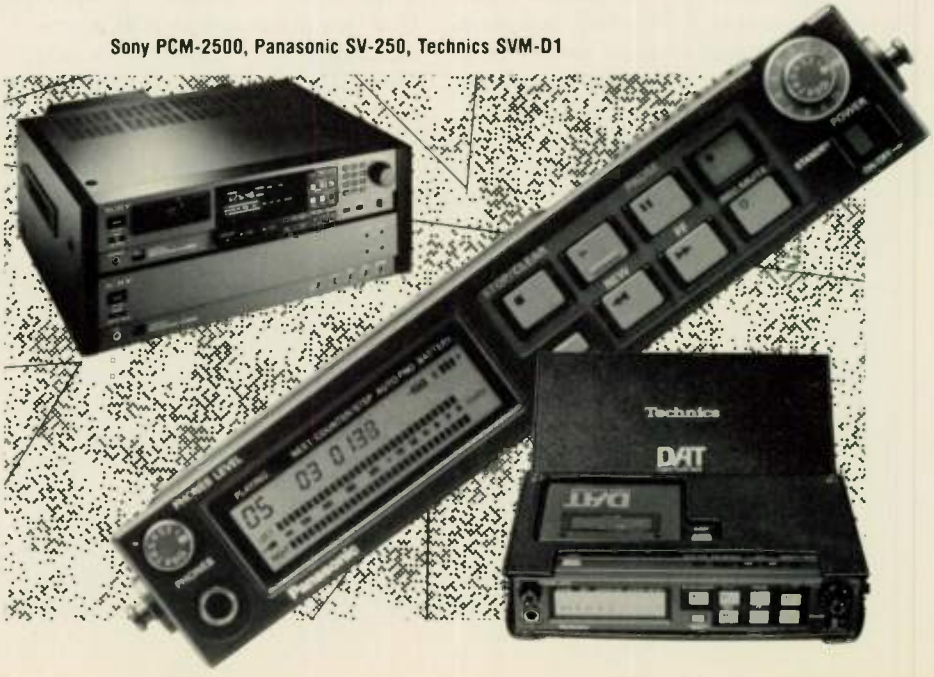
Sony Pro

Not surprisingly, Sony's professional audio division offers the most DAT models: two portables and a studio machine. The PCM-2000 was the first pro portable DAT. It is still one of the units with the most pro features on board: 48 and 44.1 kHz sampling record and playback (*and* 44.056 kHz, compatible with early, video-based, digital audio gear), balanced XLR mic/line inputs with attenuators and phantom mic power, AES/EBU (XLR-type) digital I/O, word-sync capability with BNC I/O, and more. The PCM-2000 employs two-times oversampling at both the A/D and D/A stages. It uses the Sony NP-1A rechargeable standard Betacam battery pack (with a two-hour life) and provides capable search and scan features, but eschews consumer track-programming. Specs: 20 Hz to 22 kHz ±0.5 dB, greater than 90 dB dynamic range, and less than 0.07% THD. The PCM-2000 is sold through Sony Pro Audio Division dealers. Its suggested price is $5,000.

Sony Pro's studio deck is the PCM-2500. This design uses two separate chassis, one for the DAT transport and controls, the other for the bulk of the electronics and connections. The PCM-2500 is similar to the PCM-2000 portable in most regards, minus mic preamps and the 44.056 kHz sampling rate, and with several additions. Analog ins and outs are all balanced XLR type, and BNC-type Sony digital interfaces are included in addition to XLR AES/EBU digital I/O. The PCM-2500 employs four-times oversampling filters in its D/A section. Both wired and wireless remote controls are included. The PCM-2500's specs are similar to the PCM-2000's. It is sold through Sony Pro Audio dealers, with a suggested price (recently lowered) of $3,200.

A new pro version of Sony's consumer portable (see the TCD-D10 below) is just becoming available. The TCD-D10 Pro duplicates the home portable's performance with the addition of coaxial digital I/O; pro-level, XLR mic/line analog inputs (with defeatable limiter and attenuator); and pro-level, unbalanced outputs. It adds 44.1 kHz sampling recording, but only from the digital input. The TCD-10 Pro is 10 × 2.25 × 7.5 inches and weighs 4.4 pounds with its supplied battery pack. Sony Pro Division's suggested price is to

Sony PCM-2500, Panasonic SV-250, Technics SVM-D1



be announced; I'd guess it will fall somewhere around $2,700.

Sony Home

The DTC-1000ES was one of the first DAT recorders available and consequently one of the first on the U.S. gray market. It provides the full complement of home DAT features, including extensive programming, ID, and search functions. It does not record at the 44.1 kHz sampling rate. Coax digital I/O and optical digital I/O are included. The DTC-1000ES employs four-times oversampling digital filters in the D/A conversion stage. There are no mic inputs, and consumer-level analog RCA ins and outs are provided, as is wireless remote control. The basic specs are 2 Hz to 22 kHz ±1 dB, dynamic range greater than 92 dB, and THD less than 0.07%. Gray market prices range from $1,850 to around $2,000.

The DTC-500ES is Sony's second-generation DAT. It is similar to the DTC-1000ES, with two-times oversampling A/D conversion and some refinement of the displays and convenience features. (Some gray-market literature states the DTC-500ES can record with 44.1 kHz sampling, but I could not confirm this.) Gray-market pricing on the unit checks in at around $1,850.

Sony's DTC-M100 is a Japanese-style "midi" unit—not MIDI as in musical instrument, but midi as in mid-sized. It's a compact, home DAT design similar to the DTC-1000ES but with slightly less-elevated performance specs. As far as can be determined, it does not record at 44.1 kHz. It can be found at gray market prices as low as $1,500.

Sony's TCD-D10 home portable unit shares its dimensions with the pro version above. It omits the digital I/O and offers low-impedance, unbalanced (phone jack) mic inputs. Specs are 20 Hz to 20 kHz frequency response, greater than 90 dB dynamic range, and THD less than 0.08%. Gray market prices for the consumer TCD-D10 are in the $2,600 range.

Tascam DA-50

Familiar pro name Tascam has an unusual pro DAT deck. The DA-50 incorporates TEAC/Tascam's "ZD" circuitry—a method of injecting digital dither information—at both the A/D and D/A stages. ("Dither" is a random digital signal that can help digital converters provide better low-signal resolution.) Tascam claims reduced quantization error, resulting in improved distortion performance. The rack-mount DA-50 records at 48 and 32 kHz (with digital input only for the latter), with playback at 32, 44.1, and 48 kHz. Two-times oversampling is employed at both the D/A and A/D ends, as are dual, 16-bit converters. The unit provides both balanced (XLR) and unbalanced (RCA) inputs and outputs, as well as coax and Toshiba-standard, optical, digital I/O, and uses "audiophile"-type mono-crystal wiring at critical points. A full complement of search features and a wireless remote controller are included. Specs: 1 Hz to 22 kHz ±0.5 dB, greater than 90 dB dynamic range, and less than 0.005% THD (at 1 kHz). Tascam's DA-50 is distributed through the company's professional audio dealers at a suggested retail price of $4,000.

Sony DTC-500ES

TEAC Audio

The consumer wing of Tascam's parent company, TEAC America Inc., offers a DAT deck under its high-end, hi-fi, "Esoteric" label. The R-1 is identical to the Tascam DA-50 in every regard. While TEAC claims it will distribute the unit through its Esoteric-line hi-fi dealers, no units have been imported as of this writing. Its price is expected to be similar to the DA-50's.

Technics

Under the Technics label is the SV-MD1, a consumer version of the Panasonic SV-250. The Technics unit is identical except for the substitution of unbalanced mic inputs. Through gray-market sources the SV-MD1 has been seen priced at $2,850.

The SVD-1100 home hi-fi deck from Technics appears to be identical to the Panasonic studio machine, the SV-3500. The same quasi-18-bit chip set is used, and inputs, outputs, and sampling frequencies appear to be the same. The balanced XLR ins and outs are omitted. The Technics version is found at gray market sources for around $2,500.

CONCLUSION

DAT recording offers a huge potential for boosting the quality and portability of your sounds in a fairly inexpensive way. If you keep abreast of the technology and take just a little care in your research and shopping, you should be able to go digital with a minimum of risk and cost and a maximum of fulfilled expectations.

Daniel Kumin *lives in New Hampshire, writes about music and electronics for several national publications, and occasionally even composes a little.*

FOR MORE INFORMATION...

Information on professional DAT machines may be obtained from the following manufacturers:

- Casio, Inc., Music Division, 570 Mt. Pleasant Ave., Dover, NJ 07801; tel. (201) 361-5400. Contact: Ed Alstrom. Circle reader service #601.
- Fostex Corp. of America, 15431 Blackburn Ave., Norwalk, CA 90650; tel. (213) 921-1112. Contact: Steve Teipe or Mark Cohen. Circle reader service #602.
- Nakamichi America Corp., 19701 S. Vermont Ave., Torrance, CA 90502; tel. (213) 538-8150. Contact: Dean Miller. Circle reader service #603.
- Panasonic Professional Audio Group, 6550 Katella Ave., Cypress, CA 90630. Contact: Chris Foreman. Circle reader service #604.
- Sharp Electronics Corp., Professional Products Division; Sharp Plaza, Mahwah, NJ 07430; tel. (201) 529-8731. Contact: Bruce Pollack. Circle reader service #605.
- Sony Professional Audio, 1600 Queen Anne Rd., Teaneck, NJ 07666. Tel.: East, (201) 368-5185; West, (818) 841-8711; South, (615) 883-8140; Central, (312) 773-6001. Contact: District Manager, DAT products. Circle reader service #606.
- TEAC Corp. of America/Tascam, 7733 Telegraph Rd., Montebello, CA 90640; tel. (213) 726-0303. Contact: Jim Lucas. Circle reader service #607. —*SO*

An Interview with Bernie Krause:

Interviewing a "living legend" is intimidating; besides, Krause has a reputation for being outspoken, and to him, nothing is more important than his relationship with the environment. Fortunately, he is also a warm, genuinely humble person who puts you instantly at ease. He recently achieved a great deal of success with works that combine music and sampled natural sounds, so that seemed like a logical place to begin the interview.

EM: How did you get into using sampled natural sounds, and why?

BK: We've always done that, clear back to *In a Wild Sanctuary* (1969). Paul [Beaver] and I had reached a point in the '60s where we were bored with synthesizer sounds. It was important for us to find a voice for ourselves that established us in our own right. One day, Van Dyke Parks happened to come up with the idea of incorporating material from the environment with synthesizers. The idea clicked right away; it also gave us a launching pad to make some statements about the state of our world. My background is folk music [Krause was a member of the folk group The Weavers] and this music is an outgrowth of folk music, of concerns about our environment. Ecology was a new word then.

EM: What kind of equipment could you use for sequencing animal sounds back in 1969? Was it all cut-and-splice work?

BK: I copied little slices of tape, over and over again, and took a ruler and tried to cut the material exactly to the same length. Then I would create this large loop that would be looped all around the room, and hoped that I could match it up with other pieces of tape that length. This took hours.

EM: How did you get The Nature Company involved with releasing your recent recordings?

BK: That came about as a result of a recording I'd done called *Equator*. It started with a radio benefit I was doing for Greenpeace. Mike Cotton and Prairie Prince from The Tubes came over and were listening to some of the whale recordings I did for my PhD and they said, "Let's do some tape cutting and loop that stuff, and see if we can't do a piece for the benefit." So with Prairie Prince playing drums, we looped killer whale sounds and some humpback whale sounds and came up with a piece that was the forerunner of the material I'm doing today. I tried to sell it, but everyone thought it was just a novelty. Yet it wasn't. I felt there was something more important there.

In 1983 I went to Africa for the California Academy of Sciences on a commission to record a variety of animal sounds. This material was to be produced in a seventeen-minute, day-night cycle for their African Hall waterhole exhibit, a diorama at the Academy. As it turned out, this was one of the most popular things they've ever done. I took some of that material to score my own soundscape, as one would score a film, and was very happy with the results. I tried to sell it to record companies—185 of them all over the world. Only one, Windham Hill, even bothered to send a rejection.

Finally, out of desperation, I went to The Nature Company in Berkeley and proposed to develop a whole repertoire of materials based on sound and visuals about the environment. I'd done a lot of work with whales and environmental recordings and had a fairly good library of materials [he's modest: it is reported to be the largest library ever accumulated by an individual]. I was told they weren't particularly interested, but fortunately I had left the first side of *Equator* there as an example of the stuff I wanted to do. A few days later I got a call and this guy said, "My name is Tom Wrubel, and I'm the president of The Nature Company. I just want you to know I was driving north up Highway 1 from Carmel, and I'm sitting on the side of the

● KRAUSE *from page 36*

to hear in air," Krause observes. "A hydrophone, designed for underwater work, records sounds much more accurately than we can hear them. If you put your ear to the hull of a boat when recording whales, you can hear them as the hydrophone does." There are many kinds of hydrophones, but Krause has found two that suit his purposes. He uses a B&K 8103 for work that doesn't require a lot of sensitivity, i.e., recording loud sounds that travel far. Its frequency range extends from 0.5 Hz up to about 200 kHz. The cost is around $1,200, with the required B&K amplifier adding about $2,800. In Krause's opinion, B&K builds the most durable, best quality equipment for sound measurement. Krause's other hydrophone, which is more sensitive than the B&K but doesn't have the high-frequency range, was custom-built for about $300 at the University of California-Santa Cruz. This hydrophone is more powerful and less noisy and, says Krause, "gives more texture and richness."

A choice of hydrophones is important because of the wide frequency ranges and types of creature vocalization. Krause observes that "the blind Ganges dolphin has been tested for vocalization around 356 kHz, used for echo location in a muddy river, and the sound doesn't travel far with that short a wavelength. The right whale can vocalize down to 3 Hz." These vocalizations could, until the 20th century increase in noise pollution, actually travel

ILLUSTRATION BY PAMELA PRICHETT

Sounding Out the Environment

road right now, crying. I cannot believe that these sounds are on this tape! I'll give you *anything* for this tape!" So *Equator* ended up getting released, and they've sold well over a million dollars worth of product in two years. There are seven albums out now. I've just been commissioned for one more.

EM: Time is finally starting to catch up to 1968-69 when you came up with the concept.
BK: Yeah. What's interesting is we were the first to talk about this, and we've never gotten credit for it.

EM: Of course, there are other people working on the same concept now. What do you think of Paul Winter's efforts to do music to whale compositions and incorporate natural sounds?
BK: Like so much music, Paul Winter's stuff is a result of a lot of work that was done before him. Judy Collins, in 1971, did "Farewell to Tarwathie" using humpback whales. It's part of an historical precedent that began a long, long time ago. I think his stuff is sometimes excellent. He doesn't just use animal samples to write pop songs. His stuff works because you know there's a spiritual connection there.

EM: I think you lose the spiritual component when you make animals sing *your* tune, as opposed to singing with the animals. A lot of people are using sampled natural sounds, but to me, *Nature* and *Equator* were the first to do this with any real sympathy for the sounds being used.
BK: In those records, the sounds from nature were actually used as scored elements, in a definite classical orchestral A-B-A form.

EM: Since you use sampling a lot, what do you think of the technology, per se?
BK: Some people consider digital sampling godlike in some way, but *any* kind of information storage—including recording on analog tape—is sampling. When Ussachevsky, Luening, Henri, and Stockhausen were sampling sounds of their urban environment in 1948 and cutting up pieces of tape and putting them together, they anticipated "samplers" by almost 40 years. It doesn't matter to me how a sample is made; it only matters how it is used. With some art, technology takes over and begins to rule the artist instead of the reverse. Of course, sampling possibilities are unbelievable today, and there's no way I could have done "Fish Wrap" or "Jungle Shoes" [1988] without an Emulator, Fairlight, or Synclavier. But the main question is what's the artist *expressing* with the medium? This is a moral and ethical, not technological, issue.

EM: What ethical and moral obligations do you think an artist has?
BK: Oh boy. I guess they have an obligation first of all to learn their craft very well, to have their own voice, and to be true to a vision they have of their work. Those are the ethical obligations.

EM: A lot of people who purport to be artists are chasing after much less lofty goals. Interestingly, there don't seem to be many famous people doing wonderful work; on the other hand there aren't too many people doing wonderful work who become well-known. There seems to be a tradeoff at some point in the middle. Do you feel you are too virtuous to become popular?
BK: [Quickly] No. Pete Seeger, with The Weavers, was once asked, "Do you want to make money or do you want to make issues?" He said, "I think that we can do both." I really don't hold much value in the idea of what constitutes popularity in America. I've never pursued it, and I don't think that it has much value in my life. And I'm not being virtuous about that; I don't want to put my energy into it, because I have a lot of work to do before I die. I may have twenty years left, or fifteen years left. I don't have a lot of time for *People* magazine. I *do* have time for *Electronic Musician*, though!

—Robert Carlberg

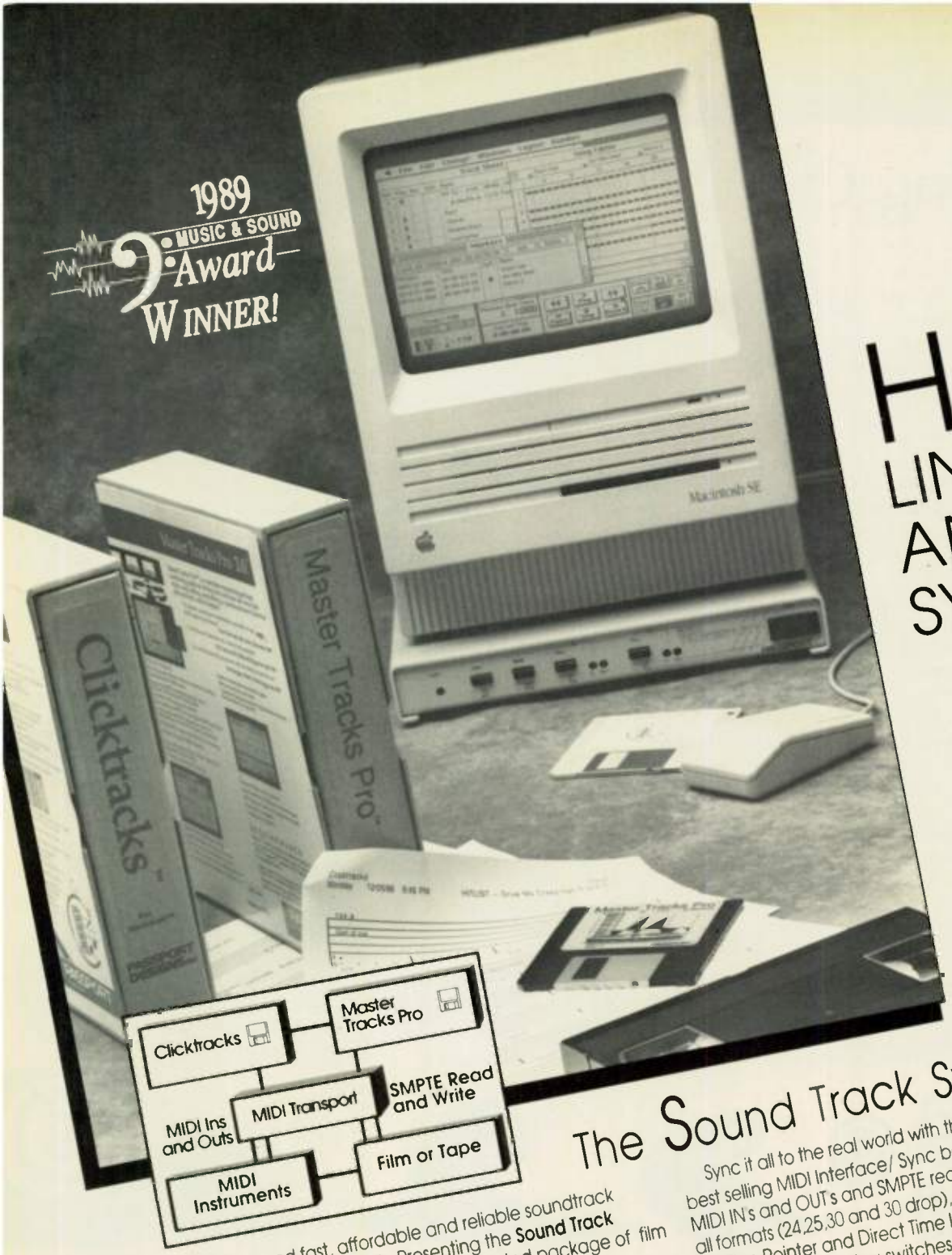
around the globe.

One of Bernie Krause's deepest concerns is human-induced noise pollution. "Go try to record in the Amazon in a place that ten years ago was relatively quiet, and you could get the material most of the time," he states. "Now, you hear chainsaws *twenty miles away*!

"Sound doesn't travel far in the ocean now because of oil-well drilling and boat noise," Krause continues. "In Hawaii, we were recording humpback whales, and sub chasers were sending out sonar signals fourteen miles away that pinned the meters, they were so loud. You hope that 'this too shall pass.'"

For terrestrial sounds, Krause records in stereo. He places his microphones in an x/y coincident pattern (nose-to-nose at a 90-degree angle), which cuts down on phase problems. Some phase problems occur when recording high-frequency sounds such as birds, insects, and bats (which make sounds in the 14 to 16 kHz range), but most of the sounds Krause records (especially mammals) are between 500 Hz and 4 kHz, where phase is not a problem.

Krause's favorite mics, though not the most useful, are the Schoeps 541 hypercardioid condensers (the CMC-5 body and preamp with the MJ-41 capsule), which he calls "the clearest, cleanest, snappiest-sounding compromises around." Recently, he had them modified by Klaus Heine for improved low-frequency balance and



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clarity, making them more sensitive and functional in the field. Without the modification, the Schoeps cost about $800 per mic; additional attachments to fight wind and other field problems cost about $500 per mic. Krause had been using Cut One filters (inserted in series with the capsule), which cut down on low-frequency noise, but with the modification and some other specialized gear (see "The Wild Sanctuary" sidebar), he no longer needs them.

The biggest problem with using condenser microphones is their inability to withstand humidity. Krause tests his mics by filling his bathroom with steam, but even though the Schoeps didn't fare well in the bathroom test, he took them to the mountain rainforest of Rwanda, hoping that by keeping them in a desiccant when not in use and "equalizing" them to the environment before using them, he could overcome the humidity problem. The Schoeps failed in three minutes, so Krause turned to his less expensive Beyer M700N-(C) hypercardioid dynamic mics, which had survived 45 minutes of steam testing. The Beyers passed the test of sitting three to four hours in the rain.

Krause had the mics mounted atop his head so the wires wouldn't entangle his body, allowing him to dispense with the shock mount and tripod and keep his hands free. He taped rubber Acoustafoam to the mic mounts, taped the mics to the headband of his earphones, and put the whole thing over a San Francisco Giants baseball cap so it wouldn't slip. Krause found the Beyers weren't as sensitive as the Schoeps; they were heavy and a bit noisier, but indestructible. These were the mics Krause was wearing when the gorilla attacked. "That's a rock and roll mic," Krause laughs. "It takes a lot more than a gorilla to destroy them."

The latest addition to Krause's microphone arsenal is a $3,400 Neumann RSM 190i-S, a selectable-pattern condenser that offers the choice of shotgun, x/y stereo, or both. It features two capsules on the side and one on the end along with a choice of sideband pickup patterns: 0, 6, or -6 dB. In x/y stereo, it provides a full cardioid or hypercardioid, and the mid-plus-side (MS) shotgun is very focused. Because it's a condenser mic, the Neumann has humidity problems, but Krause finds it to be an excellent piece of equipment and appreciates its range of options, including a pistol grip that allows it to be either handheld or mounted. Krause puts a Rycote windscreen on the Neumann, which doesn't affect the frequency but does affect the pickup pattern.

NAGRA FALLS

Krause has recorded in many places and under a variety of conditions, and the 2-track, reel-to-reel, Nagra IV-S recorder has been his closest companion. It weighs 25 pounds with tape supply, batteries, and mics and is awkward to handle in rough terrain, but it has been infallible: it worked admirably despite a plunge from a helicopter. "It's one of those heavy-duty pieces of field equipment you can always manage to fix somehow."

Krause has experimented with a Sony TCD-D10 R-DAT, but found it unsatisfactory for field work. The R-DAT's tiny, two-hour tapes are light and convenient, but the R-DAT machines don't function reliably in humid conditions. Further, in places like the mountains of Rwanda, where there's no electricity within thirty miles (not even a generator), there would have been no way to recharge an R-DAT power supply, which lasts less than an hour-and-a-half and costs over forty dollars. "If you take an R-DAT in the field,

THE WILD SANCTUARY

Wild Sanctuary Communications is the production company founded by Bernie Krause. The modest studio where much of Krause's music is produced is located in his San Francisco home, and is operated by Krause assisted by intern James Reeve.

In addition to the field equipment and previously mentioned computer software, the studio includes: an Apple Macintosh Plus and Mac II; a Bryston 370 power amp; Crown Pressure Zone Microphones (PZM); a Digital Audio Corporation DAC-150 time-based digital filter; Dolby SR/SP series noise reduction (eight channels), and 363 SR/A noise reduction (two channels); E-mu Emulator II and Emulator III; a Furman PB-40 patch bay; a Klark-Teknik DN-300 graphic EQ; *MacADIOS II* spectrum and waveform analysis program; a Moog Model 12 modular synthesizer; a Nagra IV-S stereo recorder; an Orban 622B parametric EQ; Otari MX-55 2-track and MX5050-ASR 8-track decks; a Sony TCD-5 cassette recorder and Sony TCD-D10 (R-DAT); a Soundcraft 2008 mixer; a Symetrix comp/lim/exp/ducker; a Tascam 34 tape deck; and UREI 809 studio monitors.

—SO

where will you get it serviced?" Krause asks. So he continues to use a custom-made Nagra preamp, Ampex 457 audio tape (at 15 ips), and a Nagra Master noise-reduction unit. As a backup, Krause sometimes takes a Sony TCD5 cassette recorder.

CLEANING UP

Krause's primary application of processing gear is to eliminate wind and other undesirable noise. His most powerful tool is a Macintosh Plus computer with Digidesign's *Sound Designer* graphic sample-editing software. With creative associate Matt Ward, Krause samples his taped sounds on an E-mu Emulator II or III, then uses Sound Designer to edit out the noise on both sides of the signal.

"Sound Designer is brilliant," Krause enthuses, "I rely on [Digidesign's] software more than any other." For sequencing, he uses Mark of the Unicorn's *Performer*. Krause also uses analog filters (equalizers), though he recognizes they are limited in their ability to eliminate noise. In addition, he puts an Orban stereo synthesizer on the whale sounds to give them a sense of space and movement.

For some low-frequency applications, especially in his role as an expert audio analyst for legal cases (audio forensics), Krause uses time-based, lowpass, automatic digital filters. According to Krause, "they are designed to eliminate noise, yet leave voices intact without changes in timbre, intonation, prosody [time/meter patterns], or quality." Their principle of operation is *adaptive predictive deconvolution*. The processor identifies *constant* and *nonconstant* sound impulses. Constant impulses represent background noise, and nonconstant impulses are the desired signal. It predicts, based on almost ten million operations per second, which impulses will be in what category. The filter then reduces the level of the constant signal relative to the nonconstant. In addition, it can eliminate noise from the desired signal within the same frequency band(s). However, because their frequency range does not exceed 7 kHz, automatic digital filters are useful mostly in relatively low-frequency applications.

THE URGE TO MERGE

On their dance tunes, "Jungle Shoes" and "Fish Wrap," Krause and his partners organized the sounds in families of orchestral-type "instruments." They also used Sound Designer to *combine* sounds, although most of the sounds on these recordings (such as the snapping shrimp hi-hat) are pure, sounding the way they do in nature. They wanted the fish and walrus to make up the percussion tracks, but found that their drumfish sound (one of a collection of sounds gleaned from old U.S. Navy recordings) lacked bottom. The solution was to use the drumfish for the

RECORDINGS

(Solo or with Paul Beaver)

Nonesuch Guide to Electronic Music, Nonesuch, 1968
Ragnarok, Limelight, 1969
In a Wild Sanctuary, Warner Bros., 1969
Gandharva, Warner Bros., 1971
All Good Men, Warner Bros., 1973
Citadels of Mystery, Mobile Fidelity, 1979
Revised Nonesuch Guide to Electronic Music, Nonesuch, 1979
Equator, The Nature Co., 1986
Nature, The Nature Co., 1987
Gentle Ocean, The Nature Co., 1988
Distant Thunder, The Nature Co., 1988
Mountain Stream, The Nature Co., 1988
Morning Songbirds, The Nature Co., 1988
Summer's Evening, The Nature Co., 1988
"Fish Wrap"/"Jungle Shoes" (CD-3), Rykodisc, 1988. —*RC*

attack of the sound and a sampled lion's roar for the sustain portion of the sample.

For lead voices, the Krause team listened to some more melody-oriented sounds—a coyote, some whales, and some dolphins—but they still couldn't find the right lead line. They decided to use Sound Designer to loop together certain dolphin sounds and the voice of Humphrey the Whale. (Humphrey is the famous California gray whale who became lost in San Francisco Bay and was eventually led to safety, partly by Krause playing sampled whale sounds.)

A CORNUCOPIA OF SOUNDS

Wildlife sounds are not limited to the obvious vocalizations; for example, fish emit several different varieties of sound. Krause explains: "Some make noise with their swim bladders, fins, grinding teeth; some emit an electrical charge. They have remarkable ways of putting out vibrations. The motion of swimming, using the tail fin, creates a waveform that is picked up by all the other creatures around them. If a predator, such as a shark, picks up that vibration, and it is somehow funny or wrong, the predator will go after that fish, because it's in trouble. Snapping shrimp sound mostly like bursts of static. They are a few inches long, and they snap their claws to stun prey with sound pressure. Underwater, they put out 200 dB spl. Once in a while, it's quiet, there's a lull, and you hear individual snaps." That's when you record them.

WHAT WILL HE THINK OF NEXT?

After a long hiatus from doing advertising spots (he has done over 2,500), Krause recently did a Marine World commercial, although he now has reservations about the commercial market and is very selective.

The next albums he'll do for The Nature Company will be *Tropical Jungle* and *Gorilla*. The latter is a result of Krause's trek in Rwanda, as is his latest museum sound piece for the California Academy of Sciences, an ambient backdrop for Nick Nichols's photographic exhibit about the mountain gorillas. Based on the success of "Jungle Shoes," Rykodisc has picked up the option for a new album based entirely on biological sounds, to be released sometime in late summer 1989.

Other recent projects include eleven sound exhibits for the new education center at the St. Louis Zoo. One of these is an 8-channel, holophonic-type sound sculpture, done with octagonal rows of speakers. Whales appear to swim through the listener's head, and birds fly over. Krause even uses spatial placement to accurately portray which birds perch high in the trees and which perch lower. But the sound that Krause gets a kick from is the fly sample he obtained in a trade with Leslie Schatz, a crew member on the film *The Fly II*. "We trade sounds like baseball cards. You want a gorilla, I'll trade you for a fly!" he laughs. The fly "moves" around a 70-foot room, "lands" on someone's shoulder, then flies through the rafters and all around the room.

Next, Krause plans to spend three months recording from Costa Rica all the way to Alaska, working on land controlled by the Nature Conservancy. He expects the resulting album, *Meridians*, to be distributed by The Nature Company, 750 Hearst Ave., Berkeley, CA 94710; tel. (415) 644-1337.

Steve Oppenheimer *is attempting to work a 168-hour week. At press time, the experiment has neared, but not attained, success.*

GHOST IN THE MACHINE, PART 1

Hidden deep within your instrument are test routines that can help you diagnose problems and may even save you a trip to the repair shop.

By Mark Davis

As an electronic musical instrument technician, authorized by several different manufacturers, I often see a synth, drum machine, or other MIDI device come in for repair because the machine is acting oddly or "locks up" after a few moments. In almost all of these cases the problem is not hardware, but software, and the unit simply requires a software reset and/or reinitialization. Why does this happen? Now and then an occasional bit of data ends up in the wrong place, or the wrong button gets pressed at the wrong time, causing a unit to lock up or seemingly lose data. For example, I have had several DX7s come to my bench with the complaint that the pitch wheel or some other controller function quit working. By simply saving the voice data to some other medium (disk, cartridge, etc.) and running the DX7's self-test, I've always been able to bring the unit back to fully functional status (assuming there's no real hardware problem, like a crushed part or cat food stuffed into the works).

We'll begin by covering Yamaha equipment, then move on to other manufacturers. But before initiating *any* of these procedures, make sure you follow the first rule of electronic musicianship:

Thou shalt back up thy data!

Several of the following procedures will delete all or some of the data that is stored in the machine, so save before you reinitialize or run any tests.

YAMAHA DX SERIES

■ *DX7:* When you press buttons 16 and 32 simultaneously and then press the Function button, the unit will ask you if you want to proceed with the test mode. Pressing Yes will begin the tests. To proceed with each test, the Yes button will increment to the next test; No will decrement. Note that some of the tests require a RAM cartridge or the performance pedals; the Yes button can skip those tests for which you may not have the necessary hardware. Voice data should not be affected.

■ *DX7II:* Only those models with software Version 1.6 and later possess the test procedures for this unit. To check your DX7II's version, press voice buttons 16 and 32 simultaneously while holding down the Edit button. While you are pressing these, the display will show the software revision number. If it's less than 1.6, the synth will return to the mode it was in prior to checking the software revision, since there is no self-test procedure. If you have version 1.6 or above, you will be queried whether or not you want to continue. The first of a long series of tests will check the RAM, initializing *all* Performance, Voice A, Voice B, and System Setup memory and causing a loss of all data (remember, back up first). If the RAM is good, press the Yes button again to proceed to the battery check test. At this point, you can power the unit down and reload your Voice and Performance data. The remainder of the tests are of little use to the consumer.

■ *DX7 with E! board:* This upgrade can be confusing to the operator, and it is even more so to someone who has used a DX7 but not seen an E! board menu. It is very important to know what you're doing; otherwise, it may seem that the unit is operating erratically or not at all.

The following set of procedures will completely reinitialize a DX7 with an E!

ILLUSTRATION BY LINDA BLECK

board. If you don't want to clear the Voice banks, skip sections A and B.

A. Choose a RAM bank.
1. Press Internal Memory Select;
2. Move the data entry slider to choose a bank number;
3. Choose a voice to activate that bank.

B. Erase that bank. Press:
1. The Function button;
2. The Operator Select button twice;
3. Button 19 three times (answer Yes to Bank Erase).

Remember to do the above steps to all voice banks.

C. To initialize without erasing voices, do the above procedure, but answer Yes only to Patch Map Erase and Keyboard Preset Erase. (Button 19 toggles between three parameters while in the Function/Operator mode: Bank, Patch Map, and Keyboard Preset Erase.)

D. Enter the Function Page to clear and set the global function data. Note that some buttons have more than one function, so to set each parameter for these buttons, simply press the button repeatedly until the screen displays the proper function. Press:
1. The Function button;
2. Button 2 (set to Poly);
3. Button 3 (set pitch bend range to 12);
4. Button 4 (set pitch bend step to 0);
5. Button 5 (set portamento mode to Retain);
6. Button 6 (set port/gliss to off);
7. Button 7 (set portamento time to 0);
8. Button 8 (MIDI volume=7, DX volume=7);
9. Button 9 (aux patch=000, main patch=000);
10. Button 10 (MIDI curve=Lin1, DX curve=Lin1);
11. Button 11 (MIDI high=127, MIDI low=16, DX high=127, DX low=000);
12. Button 12 (MIDI shift=000, DX shift=000);
13. Button 13 (keymode=norm, random detune=0);
14. Button 14 (MIDI transpose=00, timbre=63);
15. Button 15 (MIDI high=127, MIDI low=000, DX high=127, DX low=000);
16. Button 16 (MIDI out channel=01).

E. Now clear the other miscellaneous registers. Press:
1. The Operator Select button;
2. Button 7 (cont=off, seq=off, key=off);
3. The Operator Select button three times;
4. Button 13 (set the LED brightness to a comfortable level). Your E!quipped DX7 should now be properly initialized.

■ *DX21/27:* Enter test mode by pressing voice buttons 1 and 2 while turning on the power. This will display the ROM version and date. Before proceeding to the next test, make the following connections: cassette out to the input of an amp, the amp out to the cassette in (set for 10 dB gain), and connect MIDI in to MIDI out. Pressing the Yes button will begin the RAM, MIDI, and I/O test. A missing or bad connection will cause an error message. You can reboot at this point; RAM will be initialized.

■ *DX11:* Press and hold the Edit switch and press voice switches 16 and 32, then press Yes to initiate the RAM check. If the RAM check is okay, you can power down and start with the reinitialized voice-edit buffer, controllers, and performance parameters.

YAMAHA TX SERIES

■ *TX2/816:* Press and hold the three TF1 switches while powering up. Press the Yes/+1 switch three times to access the RAM check test; a green light indicates "okay." Power down to exit the test. No voice data should be affected.

■ *TX81Z:* Press and hold the Master Volume (left) and Cursor buttons while powering up. Then press the Inc (yes) button to initialize the MIDI parameters and load RAM with factory preset Voices and Performance setups. Power down to start fresh.

■ *TX802:* Press and hold buttons 8 and 9 while powering up, then press the Enter switch. Next, increment through the test numbers to test 56 and press and hold Enter, then +1. This will initialize the system memory buffers. Power down to restart.

■ *TX7:* Press and hold Data Yes and Mode switches while powering up, then press Yes to run through a few simple tests. This will initialize the unit, leaving all the voice data intact.

■ *FB-01:* Press and hold Sys Setup, Inst Select, and Data Entry No while powering up, then increment voice to initial-

ize the factory setup. If you have custom voices in RAM, they will be lost.

YAMAHA RX SERIES

■ *RX15:* Powering up initializes this unit without affecting data. Consult your owner's manual for clearing pattern and song data. This is sometimes required to eliminate bad data that may affect the performance of the unit.

■ *RX11:* Press and hold the Tempo and Stop/Continue switches while powering up. The RAM will automatically be checked upon starting this test. Note that all data will be lost. You may then power down to start fresh, or continue to play with the rest of the tests.

■ *RX21:* Press and hold the 3 and Stop/Continue switches while powering up. This will check ROM, RAM, and the LCD (display). All data will be lost. Power down to start fresh.

■ *RX5:* Press and hold the 7 and 9 switches while powering up, then press the +1/Yes switch. This will begin the test procedure with a system ROM and RAM check. If you want simply to reinitialize the RAM, press 1, 8, and then Start to jump directly to that point. Then press +1/Yes to initialize RAM to factory preset data. The unit will then return to normal operation.

■ *RX7:* This uses the same procedure as the RX5.

YAMAHA QX SERIES

■ *QX3 and QX7:* These units do not retain RAM data, so they automatically reinitialize on power off.

■ *QX5:* Press and hold Shift, Display, and F2 while powering up. Pressing Start initializes the RAM and returns the unit to normal operating mode. Data will be lost.

■ *QX21:* With power on, press B, Reset, TR1, and Start together. Increment to test 23 by pressing the Data +1 switch several times. Press the Track 2, Data +1, and Stop switches together to initialize the memory. Power down to start fresh.

Now that we've covered resets and initializations for most Yamaha synths and drum machines, let's move on to reinitializing units from Kawai, Korg, and Ensoniq. Not all devices will have a reset or initialization procedure; most sequencers and samplers, for instance, are reset when turned on (as are several analog synths). Always remember to back up your data before initializing (this can't be stressed enough).

KAWAI INSTRUMENTS

■ *K1:* While holding down the System button, turn on the power. This will reset all of the voices to factory standard.

■ *K3:* While holding the first three keys (C, C#, D), turn on the power. This resets all of the voices to factory standard.

■ *K3m:* While holding the first three parameter buttons (1, 2, and 3), turn on the power. As with the K3, this will reset all of the voices to factory standard.

■ *K5 and K5m:* There are no reset functions available for either unit.

■ *M-8000:* Pressing and holding button 9 while powering up will reset this unit to the factory settings.

■ *MK-10/20:* While holding the two leftmost black keys, turn the power on. This resets the factory settings and clears out the sequencer.

■ *Q-80:* Hold the red Select button while turning on the power to reset the factory sequences and parameters.

■ *R-50:* This unit, like the R-100, has two levels of reset. The "soft" reset leaves the user's data intact and resets the parameters only; the "hard" reset reinstalls *all* the factory data. To initiate a soft reset, hold the Erase button and turn on the power. To initiate a hard reset, with the power already on, hold the Accent button and press Erase. The display window will query, "Erase All?" Now press the Enter button. The display window will then ask, "Sure?" Press the Enter button again to completely reinitialize the unit.

■ *R-100:* The soft reset procedure is the same as the R-50. To initiate a hard reset, with the power already on, hold the lower half of the first function button and press Erase. Press the Enter button twice to reinstall all the factory data.

KORG INSTRUMENTS

■ *M1:* Press and hold the two top leftmost buttons and turn on the power. This will completely reset the unit, erasing all sequence data and voices. The only way to restore the factory data is with the factory cards or via a computer system-exclusive transfer.

■ *DSS-1:* Press and hold the Data Entry up and down switches while powering up. In one or two seconds, the display will indicate that you are in test mode and will show the ROM version number. Then you will be queried whether you want to continue with the floppy disk drive test. If you press Yes at this point, you will need to have a blank, formatted disk in the drive to continue. If you press

No, you will go right to the RAM test. Pressing Yes for the RAM check will cause the CPU to write zeros to the RAM and then read them back. If all is okay, you'll be able to follow the few remaining instructions to complete the self-test.

■ *DSM-1:* Holding both Cursor buttons while powering up will cause the LCD to display the test-mode message, the ROM version number, and a function selection choice of 01 through 17. To start a particular test, you can enter the number (01 through 17), then press the Yes button. Here is a listing of what each function tests:

01 Switches and LEDs;
02 Footswitch (footswitch required);
03 LCD;
04 LCD;
05 Data entry encoder (rotary dial);
06 Input level indicator;
07 Individual output levels; (These last two tests require a knowledge of audio test equipment, and I recommend that these tests be left to a technician.)
08 MIDI ports (plug a MIDI cable from MIDI in to MIDI out);
09 There is no test 09.
10 Disk drive (requires a blank, formatted disk);
11 RAM.

Tests 12-17 are specifically for technicians, not for consumer use.

■ *DW-8000:* To display the ROM version number and reset the CPU alone, press buttons 1 and 2 while powering up. This will also set the write-protect attribute on versions 07 and later. To wipe out *all* voice data and clear the RAM, press buttons 5 and 8 while powering up. Remember to back up your data before you do this, as the synth will no longer make any sound until new voices are reinstalled.

■ *DDD-1:* Pressing and holding the Yes (+1) and No (-1) buttons while powering up will reset this unit to factory installed data, erasing everything input by the user. Remember to save your data.

■ *SQD-8:* With no disk in the unit, press the Measure Memory button while powering up. You must hold the Measure Memory button until the unit buzzes before the unit enters its check mode. This will test the RAM; if good, the Tempo LED will turn green.

ENSONIQ INSTRUMENTS

■ *ESQ-1 and SQ-80:* With the power already on, hold down the Record button and press the top left "soft" button. The LCD will ask, "Erase All Memory and Reinitialize?" Press Yes to do so. The ROM version number will appear and initialization will be complete. ROM versions 2.3 and higher will automatically reload the factory sounds and erase all sequencer data. Press any button to continue.

ACKNOWLEDGMENTS

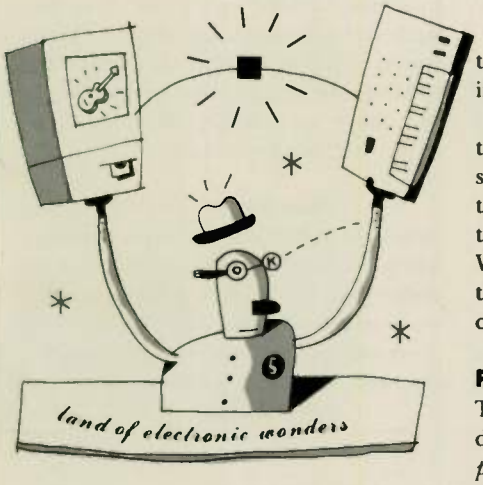
In a future article, we'll move on to Roland and Oberheim equipment. Many thanks to Jeff at Yamaha, Mike and Tom at Korg, Mr. and Mrs. Roberts at Kawai, and Steve at Ensoniq. Without their help...well, you know the story.

Mark Davis *is an electronic musician and MIDI/keyboard service technician who has successfully dodged electrocution for twelve years. He has been performing synth rescue missions for four years in Greensboro, North Carolina. At home, he hides behind his computer and arsenal of MIDI equipment.*

HANDLING MPU-401 INTERRUPTS WITH TURBO PASCAL

You too can write custom routines for an IBM/MPU-401 combination; but first we need to interrupt you with some practical tips.

By William Millar



Many of us who own an IBM computer and Roland MPU-401 MIDI interface (or compatible) would like to be able to write our own programs to do those small, special jobs that a commercial program can't do, or doesn't do to our satisfaction. To write one of these programs, though, we must know how the computer and the interface "talk" to one another.

The computer (CPU) and the interface (MPU) talk to each other by using a CPU *port*, which looks like a memory location, except it has the special purpose of sending and receiving, rather than storing, data. There are 65,536 ports on the CPU, and each one can both send and receive data. The MPU uses two ports. The first, called the *status/command* port, is port number 817 ($331 in hexadecimal notation). The second, called the *data* port, is port number 816 ($330 hex). If the CPU reads the stat/com port, it will receive a byte giving the status of the MPU. If the CPU writes to the stat/com port, it will give the MPU a command. If the CPU reads the data port, it will receive a data byte, if one is available; if the CPU writes to the data port, it will send a data byte, if the MPU is ready to receive one.

When the CPU sends a data byte to the MPU, the CPU must read the MPU's status and wait for the MPU to signal that it is ready to receive a byte. Then the CPU writes the byte to the data port. When the MPU wants to send a byte to the CPU, things get a little more complicated.

POLLING vs. INTERRUPTING

There are two ways for the CPU to get a data byte from the MPU. The first way, *polling*, is the simplest to program. Here, the CPU simply monitors the MPU stat port and waits for the MPU to signal that it has a data byte for the CPU to read. The drawback to this method is that if you want the computer to do anything else, the CPU can't monitor the MPU during the time it takes to do that other operation and may therefore miss an incoming data byte. This could be a disaster for most MIDI programs, especially a patch librarian.

The second method is *interrupting* the CPU. When the MPU has a data byte ready for the CPU, it sends an interrupt signal to the CPU. The CPU stops what it's doing, gets the data byte from the data port, puts the data byte into a buffer someplace in memory, and resumes the job it was doing when it was interrupted. This method will not miss an incoming data byte, but is harder to program than the polling method. But don't worry; the rest of this article is about the programming involved in setting up this interrupt.

HARDWARE INTERRUPTS

The MPU interface is a piece of hardware. When a piece of hardware sends an interrupt signal to the CPU, the interrupt is called a *hardware interrupt*, which differs from a *software interrupt*. Unfortunately, hardware interrupts do not go directly to the CPU. They go to another chip in the computer system called the Peripheral Interrupt Controller (PIC). This chip arbitrates which pieces of hardware will be allowed to interrupt the CPU.

Let's list the things that happen when a data byte enters the MPU MIDI in port.

1. The MPU receives a MIDI data byte.
2. The MPU sends an interrupt signal to the PIC.
3. The PIC sends an interrupt signal to the CPU.
4. The CPU gets the MIDI data byte from the MPU and stores it.
5. The CPU performs the operations the peripheral requires and sends an interrupt acknowledge signal to the PIC, not to the peripheral.

THE PIC CHIP

A significant part of the program tells the PIC to send the MPU's interrupt signal to the CPU. This is not difficult to do, but there are some tricky aspects, as the PIC chip controls *all* the hardware, including the disk drives and keyboard. If you program the PIC chip improperly, the computer may stop listening to the keyboard, and then you've lost control of the computer.

The first 1,024 bytes of CPU memory are reserved for the *interrupt vector table*. The CPU can handle 256 different interrupts. The first eight interrupts are reserved for the operating system (MS/PC-DOS). The second set of eight interrupts (numbers 8 to 15) are the hardware interrupts. The remaining interrupts are software interrupts. Each interrupt vector takes four bytes of memory to store; there are 256 interrupts, so the table takes 1,024 bytes of memory. An interrupt vector tells the CPU the starting address of the routine it must exe-

ILLUSTRATION BY J. OTTO SIEBOLD

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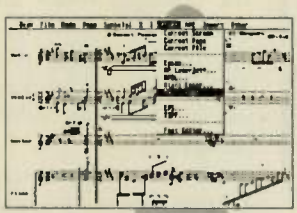
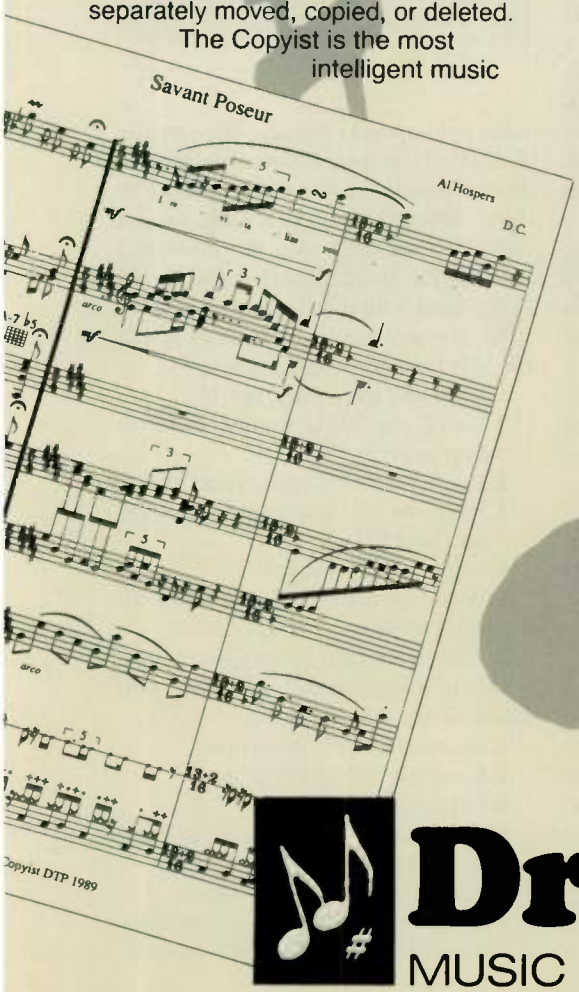


transcribes data from most popular sequencers in treble, bass, alto, and percussion clefs. Copyist converts any of the supported formats to any other and it also supports standard MIDI files.

Copyist comes in three levels to match your needs and budget; Apprentice, Professional, and DTP. All versions on all computers are file-compatible and upgradable. Each level includes a full complement of musical symbols; Treble, Bass, Alto, Tenor, Soprano, and Percussion clefs; guitar chord grids (sizable for guitar or lute); and 16 stave capability.

The Copyist contains all of the tools necessary to allow you to communicate your most complex musical idea and to sculpt your score in an extremely personal manner.



Standard Features
- Slanted or horizontal beaming
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- Smooth dynamics, and beams
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- User-defined Macros (Atari, Amiga)
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- Insert and delete notes, rests, symbols, text, bars, and pages, independently quantize timing and duration, each track separately, and 4 sections of individual tracks.
- Map any track to any stave.
- Extensive fully indexed manual
- Sequencers supported include:
  - KCS and MRS (ST/Amiga)
  - SMUS (Amiga)
  - Steinberg Pro 24 (Atari ST)
  - Texture (IBM)
  - Sequencer Plus all (IBM)
  - Mastertracks (IBM)
  - Cakewalk (IBM)
  - 48-track PC (IBM)
  - Standard MIDI files
- Standard printers supported:
  - Epson FX
  - HP Deskjet
  - HP Inkjet
- **Apprentice** contains all standard features and allows 5 pages per score.
- **Professional** contains all standard features plus:
- Score length is 50 pages
- Printer support:
  - Atari laser printer
  - HP Laserjet Plus
  - HP Plotters (ST and IBM)
- User-editable Macros
- Symbol editor
- Part generator
- Scores to sequencer formats utility.
- **DTP** contains all Apprentice and Professional features plus:
- Score length is 100 pages
- Imagen Ultrascript support
- Postscript printer support
- Includes Adobe Sonata music fonts
- Utility to convert files to TIFF and EPS formats.

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cute when it receives an interrupt signal for a particular interrupt number.

The PIC can handle eight peripherals. It has eight incoming interrupt request wires, or lines. These IRQ lines are numbered 0 to 7. These eight lines are "mapped" to the CPU's interrupt numbers 8 to 15. So, PIC IRQ0 is the same as CPU interrupt 8. The MPU connects to the PIC IRQ2 line, which is the same as the CPU's interrupt 10. Thus, when the MPU sends an interrupt to the PIC via IRQ2, the interrupt will be sent to the CPU and the CPU will execute a routine whose starting address is stored in the interrupt vector table at position 10.

Our mission, should we decide to accept it, will be to place the starting address of our MPU interrupt handler in the interrupt vector table at interrupt number 10 and tell the PIC that interrupts entering IRQ2 must be sent to the CPU. This must be done without messing up any of the other interrupt-handling routines.

The PIC has an interrupt mask register that tells it which of the IRQ lines will be permitted to interrupt the CPU. This mask register is "connected" to the CPU via port $21. Each bit in this register corresponds to an IRQ line. To enable an IRQ line, put a 0 in the corresponding bit in the mask register. So, to enable the MPU interrupts, we must put a 0 in the number 2 bit of the PIC's interrupt mask register.

There is a strict procedure for doing this. First we must turn off the CPU's interrupts. This tells the CPU that it is to ignore all interrupts. Then we read the PIC mask register. Set the third (bit number 2) bit to 0 by ANDing it with $FB, then write this new value back into the PIC mask register. Finally, turn the CPU interrupts back on.

Now, when the MPU gets a byte from the MIDI line, it will send an interrupt signal to the PIC, and the PIC will signal the CPU that it must execute the routine whose starting address is located at interrupt 10.

But wait a minute; interrupt vector 10 must point to *our* routine. How do we put the starting address of that routine into the interrupt table? Well, it's not difficult with Turbo Pascal 4.0. Turbo has two handy little procedures that will install this vector for us, GetIntVec() and SetIntVec().

First we use GetIntVec() to get the currently stored vector and put this value in temporary storage. Then we use SetIntVec() to put the starting address of our routine in the table, and we're done. When the program ends, we put the old value back into the table and turn the PIC IRQ2 line off by placing a 1 in the mask's bit number 2 position.

So, the sequence of events to install the MPU interrupt handler is:

1. Read and store interrupt 10.
2. Install the MPU handler address into interrupt 10.
3. Disable the CPU interrupts.
4. Read the PIC interrupt mask register (port $21).
5. AND this value with $FB.
6. Write the new value into the PIC mask register (port $21).
7. Enable the CPU interrupts.

When the program ends, we must undo all this. The steps are:

1. Disable the CPU interrupts.
2. Read the PIC interrupt mask.
3. OR this value with $04.
4. Write the new value back into the PIC interrupt mask.
5. Enable the CPU interrupts.
6. Write the old, number 10 interrupt vector back into the interrupt table.

INTELLIGENT MODE VS. DUMB MODE

The MPU has two operating modes. The *intelligent* mode, which keeps track of MIDI system timing while the CPU takes care of other matters, is used for sequencing programs. The UART mode, sometimes called *dumb* mode, makes the MPU operate like a simple serial interface, such as the RS-232 interface used in computer communications. If you plan to write your own sequencing program, you probably will be using the intelligent mode, and your programming abilities are such that you don't need to read this article.

The UART mode sends to the CPU whatever data comes in from the MIDI line and, conversely, puts on the MIDI line whatever data byte the CPU sends. The MPU powers up in the intelligent mode. To put the MPU into the UART mode, you must send a command to the MPU through the stat/com port.

THE MPU INTERRUPT HANDLER

The interrupt handler is the toughest part of the program to write. Each program must have its own custom-written interrupt handler, because the job the handler must do is different for each application. The hardest handler to write is for a sequencing program; the handler used in the MIDIMON.PAS program included with this article is the easiest kind to write. This interrupt simply takes the incoming MIDI data byte and puts it into an incoming data buffer, where it will be read by another part of the program later on. Every time a byte enters the MIDI port, the byte is simply put into the buffer, and a position pointer is incremented. The kind of buffer we are using here is called a *circular queue*, because when the pointer reaches the end of the buffer memory, it is reset back to the start. When the buffer is read, another position pointer is incremented. If these two position pointers are equal, there is no data in the buffer. It is important to make the buffer at least twice the size of the expected incoming data dump, because it is possible for the incoming pointer to "catch up" to the outgoing pointer. If this happens, older data that has not been read yet will be lost.

THE MIDI LINE MONITOR PROGRAM

Let's look at the program listing and discuss the more important procedures. The first five procedures are called *inline procedures;* these are short, machine language operations that must be used in other procedures and should be executed rapidly. This kind of procedure is described in the Turbo Pascal manual on page 268. Enable_MPU_interrupts reads the PIC mask, sets bit 2 to 0, and writes the mask back into the register. Disable_MPU_interrupts writes a 1 in bit 2 of the PIC interrupt mask. Ack_int_to_PIC sends the interrupt acknowledge signal to the PIC chip. The next procedure is the interrupt handler.

The interrupt handler disables the MPU interrupts, then enters a while loop, which checks the MPU stat port and reads all available data from the port. The data byte is stored in the incoming data buffer. The variable buffer_head points to the array location where the next byte is to be stored; when a byte is put there, buffer_head must be incremented. Check to see if the value

MIDI Line Monitor Program Listing

```
{-----------------------------------------
 MIDI Line Monitor
 Language: Turbo Pascal 4.0
 Hardware: IBM PC or Clone,
           MPU-401 MIDI inteface.
-----------------------------------------}
Program MIDI_Line_Monitor;

USES dos, crt;

CONST
  hexdigits : String[16]
            = '0123456789ABCDEF';
  spc = ' ';
  esc = #27;
  MPU_reset      = $ff;
  MPU_UART_mode  = $3f;
  MPU_ack        = $fe;
  MPU_dataport   = $330;
  MPU_statport   = $331;
  MPU_comport    = $331;
  MPU_data_available_mask = $80;
  MPU_data_ready_mask     = $40;
  MPU_interrupt_number = 10;
  buffer_start = 1;
  buffer_end = 128;

TYPE
  hexbytestring = STRING[2];
  MPU_comdata_send_buffer
  = ARRAY[ 1..128 ] OF Byte;
  data_buffer = array[ buffer_start..
                buffer_end ] of byte;

VAR
  MPU_indata_buffer : data_buffer;
  MPU_in_UART_mode : Boolean;
  buffer_head,
  buffer_tail : Word;
  old_int_vec : Pointer;

PROCEDURE disable_CPU_interrupts;
          INLINE( $fa ); { CLI }

PROCEDURE enable_CPU_interrupts;
          INLINE( $fb );  { STI }

PROCEDURE disable_MPU_interrupts;
          INLINE($fa/$ba/$21/$00/
          $ec/$0c/$04/$ec/$fb);

PROCEDURE enable_MPU_interrupts;
          INLINE($fa/$ba/$21/$00/
          $ec/$24/$fb/$ec/$fb);

PROCEDURE ack_int_to_PIC;
          INLINE($ba/$20/$00/$b0/$20/
          $ec);

PROCEDURE MPU_interrupt_handler;
INTERRUPT;
BEGIN
  disable_MPU_interrupts;
  WHILE (( Port[ MPU_statport ] AND
    MPU_data_available_mask ) = 0 ) DO
    BEGIN
      MPU_indata_buffer[
              buffer_head ] :=
                  Port[ MPU_dataport ];
      If ( buffer_head < buffer_end )
        THEN Inc( buffer_head )
        ELSE buffer_head :=
             buffer_start
    END;
  enable_MPU_interrupts;
  ack_int_to_PIC
END;

PROCEDURE install_MPU401;
BEGIN
  buffer_head := buffer_start;
  buffer_tail := buffer_start;
  GetIntVec( MPU_interrupt_number,
             old_int_vec );
  SetIntVec( MPU_interrupt_number,
             @MPU_interrupt_handler );
  enable_MPU_interrupts;
  MPU_in_UART_mode := False
END;

PROCEDURE uninstall_MPU401;
BEGIN
  disable_MPU_interrupts;
  SetIntVec( MPU_interrupt_number,
  old_int_vec )
END;

FUNCTION get_data_from_MPU( VAR data :
         Byte ) : Boolean;
VAR
  valid : boolean;
BEGIN
  disable_MPU_interrupts;
  valid := (buffer_head<>buffer_tail);
  enable_MPU_interrupts;
  IF ( valid ) then
    begin
      data := MPU_indata_buffer[
                      buffer_tail ];
      if ( buffer_tail < buffer_end )

        THEN Inc( buffer_tail )
        ELSE buffer_tail := buffer_start
    end;
  get_data_from_MPU := valid
END;

PROCEDURE send_command_to_MPU(
          command : Byte );
VAR
  data : Byte;
BEGIN
  REPEAT
  UNTIL (( Port[ MPU_statport ] AND
    MPU_data_ready_mask ) = 0 );
  disable_MPU_interrupts;
  Port[ MPU_comport ] := command;
  IF ( command = MPU_reset )
    AND ( MPU_in_UART_mode )
    THEN MPU_in_UART_mode := False
    ELSE REPEAT
           REPEAT
           UNTIL (( Port[ MPU_statport ]
           and MPU_data_available_mask)
           = 0 );
           data := Port[ MPU_dataport];
           IF ( data <> MPU_ack ) THEN
             BEGIN
               MPU_indata_buffer[
               buffer_head ] := data;
               If ( buffer_head <
                  buffer_end )
                 THEN Inc( buffer_head)
                 ELSE buffer_head :=
                      buffer_start
             END
         UNTIL ( data = MPU_ack );
  IF ( command = MPU_UART_mode )
    THEN MPU_in_UART_mode := True;
  enable_MPU_interrupts
END;

FUNCTION byte2hex(n:byte):hexbytestring;
VAR
  hinib,
  lonib : Byte;
BEGIN
  hinib := ( n AND $f0 ) shr 4;
  lonib := n AND $0f;
  byte2hex := hexdigits[ hinib + 1 ] +
              hexdigits[ lonib + 1 ]
END;

PROCEDURE writebyte(s2 :hexbytestring);
BEGIN
  Write( spc, s2, spc )
END;

PROCEDURE main_screen;
VAR
  midibyte : Byte;
  ch : Char;
BEGIN
  Clrscr;
  WriteLn( 'MIDI Line Monitor -- ',
           'Version 1.0' );
  WriteLn( 'Press Esc to Exit.' );
  WriteLn;
  WriteLn( 'Incoming MIDI Data:' );
  WriteLn( '-------------------',
           '-------------------',
           '-------------------',
           '---------------' );
  Window( 1, 6, 80, 25 );
  install_MPU401;
  send_command_to_MPU( MPU_UART_mode);
  REPEAT
    IF ( get_data_from_mpu( midibyte ))
      THEN writebyte(byte2hex(
             midibyte));
    IF ( KeyPressed ) THEN
      ch := ReadKey
  UNTIL ( ch = esc );
  send_command_to_MPU(MPU_reset);
  uninstall_MPU401;
  Window( 1, 1, 80, 25);
  clrscr
END;

BEGIN
  Main_screen
END.
```

of buffer_head is less than the end of the buffer. If it is, increment buffer_head; if not, set buffer_head to the start of the buffer. Lastly, enable the MPU interrupts again and send the interrupt acknowledge signal to the PIC chip.

The install_MPU401 procedure initializes the buffer_head and buffer_tail variables. It stores the old interrupt 10 vector and installs the starting address of the handler. Then it turns the MPU interrupts on.

The uninstall_MPU401 procedure turns off the MPU interrupts and restores the old value of the interrupt 10 vector.

The function get_data_from_MPU returns two values. The first is the value of the function itself, which is a Boolean function so it returns either true or false. If the function is true, then the second value is returned, and the data byte in the variable "data" is a valid data byte. If the function is false, the value of "data" is the same as the last time the function was called. Notice the variable called buffer_tail. This variable points to the position of the data byte to be read next. If buffer_head is not equal to buffer_tail, then there is data in the incoming data buffer. The data is read, and then buffer_tail is incremented the same way that buffer_head is incremented by the interrupt handler.

The procedure to send a command to the MPU is a little complicated, due to the way the MPU operates in its intelligent and UART modes. When the MPU receives a command in its intelligent mode, it sends a command-received acknowledgment back to the computer. If the MPU is in its UART mode, as it is in the present example, the only command the MPU will listen to is the reset command, and it will not return the acknowledge signal. This means that we must keep track of whether the MPU is in its intelligent or UART modes, or the computer may hang up while waiting for an acknowledgment that will never come.

The procedure first waits for the MPU status to say that the MPU is ready to receive a command. This is the repeat-until loop at the beginning of the procedure. A while loop will work as well. The MPU interrupts are disabled. If the command being sent is the reset command, and the MPU is in its UART mode, do not wait for an acknowledge signal, because the MPU will not send one. Sending the reset command in the

The code provides a start at writing programs that can do special MIDI jobs.

UART mode will switch the MPU back into its intelligent mode.

If the MPU is intelligent, we must wait for the acknowledge signal. However, the MPU may not send the acknowledge right away; it might first send a data byte that is pending and then send the acknowledge. Thus, the routine that checks the acknowledge signal must store any other incoming byte in the incoming data buffer the same way the interrupt handler would store that byte. Finally, if the command sent is the UART mode command, set the UART mode to "true," so the procedure can act appropriately the next time it is called, and turn the MPU interrupts back on.

IMPROVEMENTS AND EXPANSIONS

Because of space limitations, the Pascal code presented here is not ideal. The code to handle the MPU-401 should be in a separate Turbo Pascal Unit (perhaps called MPU401.PAS). Then the initialization block for that unit could automatically install the interrupt handler on program start, and a unit exit procedure could uninstall the handler on program termination. This way, the handler will be properly uninstalled no matter why the program is terminating. If the MIDI line-monitor program presented here crashes, the interrupt handler will not be properly removed.

The code presented here could be cleaned up a bit too. I have not used optimum Pascal programming techniques here, because I had to make the code fit into a 40 column line and be as short as possible. However, the code does work as presented and provides a start at writing your own programs to do those special little MIDI music jobs. Happy hacking!

William Miller *is a guitarist who learned to play MIDI keyboards to reduce his dependence on session players. He teaches electronics at Grand Rapids Junior College in Michigan and is working on a Ph.D. in physics.*

THE ELECTRONIC MUSICIAN MIDI CHANNELIZER

If you've been hampered by a synth that can transmit MIDI data only on a limited number of channels, but not the ones you need, those days are over.

By Tim Dowty

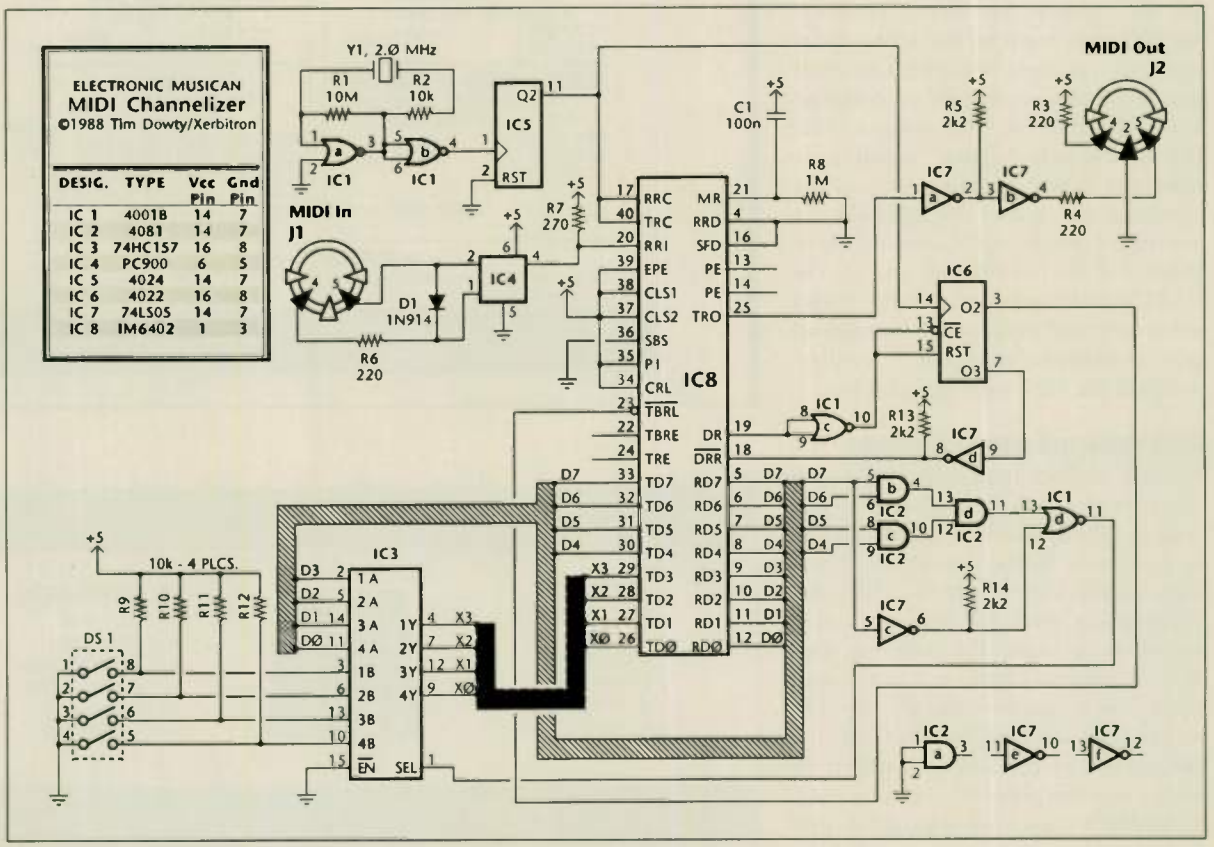

FIG. 2: Schematic for the EM MIDI Channelizer. A +5 volt power supply (not shown) is also required.

This low-cost, easy-to-build circuit *channelizes* MIDI data, in other words, transforms the channel IDs of incoming MIDI data into outgoing MIDI data with a new channel ID of your choice. You can select channels 1 to 16 for the output channel ID, using a four-position, Dual In-line Package (DIP) switch. Fig. 1 shows one way to insert the EM Channelizer into the data stream.

I use the Channelizer with my old DX7, which can transmit only on channel 1, to add more channel-send capabilities. I've found that lots of other synths can be updated with this box, too.

CIRCUIT BACKGROUND

If you're a regular reader, chances are this circuit looks somewhat familiar: it's built on the same framework as an earlier design (see "Build the EM MIDI Channel Filter" in the October '88 issue).

The circuit replaces the part of the MIDI data stream that specifies the MIDI channel with your DIP switch-selected channel. Substituting the four bits that specify the channel is pretty straightforward, but *locating* those bits among the sea of MIDI data can be tricky. (For details on MIDI's channel mechanism, see the article referenced above.) Fortunately, the people who devised the MIDI spec did an extremely intelligent job, so all the Channelizer has to do is to find the status bytes that indicate channel messages (not too

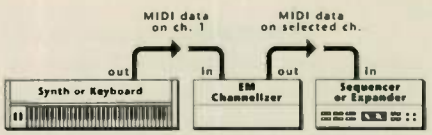

FIG. 1: The EM MIDI Channelizer routes all incoming channel data to the selected channel(s).

hard) and replace the lower four bits of these bytes with the binary representation of the selected channel.

THE CIRCUIT

Fig. 2 shows the Channelizer's schematic. Channelizing is a three-step process:

1. Receive each MIDI byte and convert it to its parallel equivalent.
2. "Look" at the byte to see whether it is carrying channel information and, if so, substitute the selected channel.
3. Convert each byte back to its serial form and retransmit it.

What I call the Transmit/Receive (T/R) section of the circuit performs the first and third tasks, while the Selection Logic circuitry takes care of the second task.

THE TRANSMIT/RECEIVE SECTION

IC8, an IM6402 Universal Asynchronous Receiver/Transmitter (UART), forms the heart of the Transmit/Receive section. This chip performs the serial-to-parallel and parallel-to-serial conversions as follows: the receiver half of the chip takes serial data presented to its RRI input (pin 20) and assembles it into a parallel equivalent before putting the data on the Received Data pins (RD0-RD7). Along with outputting the data, the UART takes the Data Received (DR) output at pin 19 high to indicate that a newly received data byte is available. The transmitter half works in reverse of the receiver: a parallel byte presented to the transmit data pins (TD0-TD7) is serially sent out the TRO output (pin 25) in response to a low-to-high transition on the TBRL input (pin 23).

The 6402 requires two external clock signals, one for the transmitter and one for the receiver, each at sixteen times the respective sections' bit rate. Since our transmit and receive data rates match, the RRC and TRC clock inputs (pins 17 and 40) are tied together and driven by a common clock signal. The circuitry around IC1a and IC1b provides a 2 MHz clock to IC5's input (pin 1), which divides the clock by four to generate the master clock frequency required by the UART:

2 MHz ÷ 4 = 500 kHz = 16 x 31.25 kHz

(31.25 kHz is the MIDI bit rate.)

The connections to pins 34 to 39 set the UART's operating parameters to 8 data bits, 1 stop bit, and no parity for MIDI compatibility. IC4, D1, R6, and R7 make up a standard MIDI input circuit

that converts MIDI-current signals to TTL/CMOS levels. The converted serial data goes to the UART's serial data input. IC7a, IC7b, R3, R4, and R5 perform the output interface function, converting 0 to +5 volt logic levels at the UART's serial output (pin 25) to MIDI-current loop signals.

THE SELECTION LOGIC

The Selection Logic is the assemblage of logic elements that comprise the rest of the circuitry, and determines—on the fly—whether or not each byte received by the UART should have a new channel stamped on it. The logic level at IC1d's output (pin 11) indicates the result of the Selection Logic's tests, which we'll go into later. If the output is high, a new channel replaces the lower four bits of the current byte before it is retransmitted. If the output is low, the current byte is retransmitted "as is."

IC1d's output connects to pin 1 of IC3, a 74HC157 quad 1-of-2 multiplexer. This chip works as a four-pole, double-throw switch for logic signals, where the level at pin 1 (the Select input) determines which way the switch is thrown. If pin 1 is low, the inputs marked 1A-4A go to the four outputs (1Y-4Y). Otherwise, with pin 1 high, inputs 1B-4B go to the

PARTS LIST

RESISTORS (1/4 W, 5% tolerance)

R3, R4, R6	220 ohms
R7	270 ohms
R5, R13, R14	2k2 (2.2k)
R2, R9-R12	10k
R1	10M
R8	1M

CAPACITORS

C1	100 nF (0.1 µF)

SEMICONDUCTORS

D1	1N914 (or equiv.) small-signal diode
IC1	4001 quad NOR gate
IC2	4081 quad AND gate
IC3	74HC157 quad 1-of-2 multiplexer
IC4	PC900 optoisolator
IC5	4024 binary counter
IC6	4022 1-of-8 counter
IC7	74LS05 hex inverter (open collector)
IC8	IM6402 UART

OTHER PARTS

Y1	2.0 MHz crystal
J1, J2	5-pin female DIN connector
DS1	4-position DIP switch

MISCELLANEOUS

Wire, IC sockets, solder, case, 5 volt power supply, etc. If you wire-wrap the circuit, you'll also need: one 40-pin wire-wrap socket, two 16-pin wire-wrap sockets, four 14-pin wire-wrap sockets, and one 8-pin wire-wrap socket for the PC900.

outputs. The A inputs connect to the lower four bits of the received data RD0-RD3, while the channel-selection DIP switch drives the B inputs. The outputs of IC3, the multiplexer, connect to the lower four bits of the Transmit Data byte, TD0-TD3, thus—and this is the crux of the whole channelizer circuit—the logic level on pin 1 controls whether the retransmitted data byte contains the original lower four bits or the bits currently selected on the DIP switch. **Fig. 3** shows the DIP switch settings for each of the sixteen channels.

1 = ON
0 = OFF

DIP Switch

Channel	4	3	2	1
1	1	1	1	1
2	0	1	1	1
3	1	0	1	1
4	0	0	1	1
5	1	1	0	1
6	0	1	0	1
7	1	0	0	1
8	0	0	0	1

DIP Switch

Channel	4	3	2	1
9	1	1	1	0
10	0	1	1	0
11	1	0	1	0
12	0	0	1	0
13	1	1	0	0
14	0	1	0	0
15	1	0	0	0
16	0	0	0	0

FIG. 3: DIP switch settings used to specify any of the sixteen possible MIDI output channels.

Let's focus on the signals that determine the logic level controlling the 74HC157 multiplexer, starting with the four gates that supply the inputs to IC1d. The first of these gates, IC7c, detects MIDI status bytes. The other three gates, IC2b, c, and d, detect MIDI system message status bytes. Remember, from our earlier background discussion, that we want to stick a new channel on all *channel message* status bytes. Another way of saying that is we want to connect the DIP switch bits on all status bytes *except* system message status bytes. This logic is implemented as follows: NOR gate IC1d's output will be low except when *both of its inputs are low*, therefore, the original lower four bits of each received MIDI byte will be preserved if either, or both, of IC1d's inputs is high. If you take a close look at the schematic, you'll see that the only time we'll have this both-inputs-low condition is when the data appearing on the UART's RD pins is a status byte and *not* a system message status byte.

IC6 and IC1c generate a couple of required control signals. IC6 is a 4022 divide-by-8 counter with "1-of-8" outputs, meaning that instead of working like most counter chips and counting input clock pulses in binary or BCD (Binary Coded Decimal), the 4022 works like a sequencer, taking each of its outputs high for one clock period, in turn, one after the other.

IC6 starts counting when IC8's DR output (pin 19) goes high, indicating that a MIDI byte has been received and is present on the RD data pins. IC1c is hooked up so that when DR goes high, IC6 starts counting from its reset state. Two clocks later, IC6's pin 3 goes high, telling the UART to transmit the data on its TD pins. The next clock cycle takes pin 7 high, which resets the UART's receiver in preparation for the next byte.

One last circuit element, the C1/R8 network, holds the UART's MR (Master Reset) input high for a short time when power is first applied to the circuit. This insures that the UART comes up in a reset state and prevents spurious garbage data from being transmitted during power-up.

BUILDING THE CIRCUIT

Fig. 4 shows the wire-wrapped prototype of the EM Channelizer. The PC900 is available from EM Bookshelf (see FYI page for information), and the other parts are available from mail order suppliers. Three mail order companies I use a lot are: Jameco Electronics, tel. (415) 592-8121; Mouser Electronics, tel. (800) 992-9943; and Digi-Key Corp., tel. (800) 344-4539.

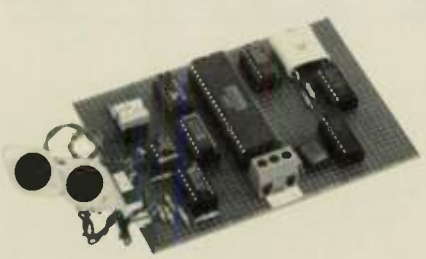

FIG. 4: A wire-wrapped prototype of the EM MIDI Channelizer.

If you work carefully and take the time to do a static wiring check (see "Build the EM MIDI Interface" in May '86 **EM**), the circuit should go together easily and work immediately on power-up. Since the circuit utilizes CMOS-family logic elements, the Channelizer draws very little current and has excellent noise immunity. The price you pay is that, as a rule, the unused inputs of all CMOS devices have to be hooked up to either power or ground. (Note toward the bottom of the schematic that IC2a's inputs connect to ground. The two unused IC7 gates are also shown here, but their inputs can be left "floating," since they are TTL gates.)

The logic elements determine—on the fly—whether or not each byte received by the UART should have a new channel stamped on it.

FOR MORE INFORMATION

Several readers have contacted me to ask for sources of information on the components used in my designs, especially the Intersil IM6402 UART. The best place to get pinout, timing, and application information is a manufacturer's data book. If you work in the electronics industry or appear to be a quantity buyer of electronic components, you should be able to get these books from an electronics distributor or directly from the manufacturer at no charge. If you're in another line of work, the books are still available, but chances are you'll have to pay for them. Large electronic retail outlets sell the books. Sometimes mail order firms that have data books in their catalogs will photocopy the pages describing a particular part for you, if you indicate that you want the companion "data sheet" when you place your order for the part. This may add a little extra to the price.

If you live in or near a "greater metropolitan area," check out college campus and retail-chain bookstores. They often carry "everything you always wanted to know about interfacing"-type books that contain component data along with example circuits.

As always, happy building!

Tim Dowty *lives in San Diego where he works as a design engineer, plays his Stratocaster, and enjoys baseball.*

QUESTIONS AND ANSWERS:
Big Top Tech-xpert

Inverting your keyboard response lets you attempt new musical heights. Step right up and find out how to do this and other amazing electronic feats.

By Alan Gary Campbell

Q. I'd like to invert the response of my keyboard like Joseph Zawinul did with his ARP 2600s. You're supposed to be able to do this with the Fender Polaris, too, but how? Is there a way to generate an inverted response on MIDI keyboards in general?

A. An inverted keyboard response swaps keyboard note-assignments in a "mirror-image." For example, on a 5-octave, 61-note, C-to-C keyboard, high C becomes low C, F2 becomes G2, G2 becomes F2, etc. Only F#2—the "pivot" key—stays the same. This can generate some very interesting, unusual scales and chord voicings, effectively interchanging the strengths and weaknesses of the left and right hands. Besides, it's just plain weird.

To "fake" an inverted response with the Polaris, set the oscillator pulse widths at minimum, so that the waveforms are inaudible. Set the filter resonance at maximum (self-oscillation), envelope depth at zero, touch sensitivity off, and cutoff at an audible pitch. Adjust filter keyboard tracking for a *negative* setting that provides an inverted, five octave range. Adjust the volume envelope, as required; adjust filter cutoff to tune. (Two factory programs that use this trick are included in the Polaris Volume II Program Cassette, part number 306565, available from Fender dealers or factory-direct for $32.50 postpaid; direct orders must be prepaid. Write: Customer Service Division, Fender Musical Instruments, Inc., 1130 Columbia Street, Brea, CA 92621.)

This technique will work with any analog or hybrid synth that provides stable filter oscillation and accurate, adjustable, negative VCF (voltage-controlled filter) keyboard tracking. You can add auto-glide and pitch-transient effects via the filter envelope provided so the envelope generators are free of offsets that affect tuning. The disadvantage of this technique is that it wastes the timbral capability of the oscillators.

A more general method is to employ an Axxess Mapper, Yamaha MEP4, or other MIDI data-altering device or program to map or transform the notes numbers into the required mirror image. The MEP4 contains such an algorithm as a preset. Connect the keyboard's MIDI out to the MIDI processor's input and the processor's output to the keyboard's MIDI in. Of course, this only works when used with a keyboard having *local off* capability (in which the sound generating elements are disconnected from direct keyboard control) or when the processor is inserted between the keyboard controller and an exterior sound module.

A Yamaha DX7 (original type) with the Grey Matter Response E! retrofit can generate an inverted response via the microtuning routines. The DX7S, DX7IID/FD, and TX802 have this capability straight out of the box.

The circuit in Fig. 1 will offset and invert the control-voltage (CV) output from an exponential-type, 1 volt/octave controller (*a la* ARP 2600). Normally, you patch the circuit between a keyboard CV output and an oscillator CV input. Perf board construction is okay. Use only 1% or 2% metal film resistors and cermet pots (or trimpots); match R6 and R7 as closely as possible. Refer to

ILLUSTRATION BY HAL MAYFORTH

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Mark of the Unicorn Performer 2.4	Mac
Opcode Systems Vision, *NEW*	Mac
Passport Designs Master Tracks Pro & Junior	All
Sonus Masterpiece	Atari
Twelve Tone Systems Cakewalk	IBM
Voyetra Sequencer Plus Mk I, II,III	IBM
Hybrid Arts Midisoft Studio Advanced *NEW*	Atari

SCORING & COMPOSITION

digidesign Q-Sheet (SMPTE/MIDI)	Mac
Dr. T's Music The Copyist I, II, III	Amiga, Atari, IBM
Electronic Arts Dlx. Music Cst	Mac, Amiga
H.B. Imaging Music Engraver	Mac
Intelligent Music "M"	Amiga, Atari, IBM, Mac
Jam Factory, Upbeat	Mac
Jim Miller Personal Composer	IBM
Mark of the Unicorn Prof. Composer	Mac
Opcode Systems Cue 2.0	Mac
Passport Designs Score	IBM
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Laurie Speigel Music Mouse	Amiga, Mac

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Passport Designs	All
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Sonus 7th Heaven	Mac
Take Note Software Take Note	Atari

MIDI INTERFACES

CMS 401 MIDI Interface	IBM
Music Quest MSS-1, MQX-32	IBM
Opcode Systems	Mac
Passport Designs MIDI Interfaces. Apple, C64/128,	Mac
MIDI Transport	Mac
Roland MPU-IPC	IBM
Southworth JamBox 2 and 4	IBM, Mac
Voyetra OP-4000, OP-4001, V-4001	IBM

HIGHLIGHTS & COMBINATIONS

Sonus SMX 2000	All
Sonus Mac Face	Mac
Dr. T's KCS w/Phantom and Copyist II	Atari ST
digidesign Creator/Notator	Atari ST
Dr. T.'s KCS and Copyist II	Atari ST
Roland MT-32	All
Mark of the Unicorn Performer w/Composer	Mac
Opcode Studio Plus Two w/Sequencer	Mac
Passport MIDI Transport w/Master Tracks Pro and Click Tracks	Mac
CMS 401 Interface w/Twelve Tone Systems Cakewalk™	IBM
Music Quest MQX-32 w/Cakewalk Professional	IBM
Music Quest MCC-1 w/Twelve Tone Systems Cakewalk™	IBM
Music Quest MSS-1 Starter Pack	IBM
Music Quest MQX-32 MIDI Interface (Read/Write-SMPTE)	IBM
Roland MPU-IPC w/Twelve Tone System Cakewalk™	IBM
Roland MPU-IPC w/Personal Composer	IBM
Voyetra V-4001 w/Sequencer MK III	IBM
Voyetra V-4000 w/Sequencer MK I ver. 1.0	IBM
Voyetra V-4001 w/Sequencer MK I ver. 2.0	IBM

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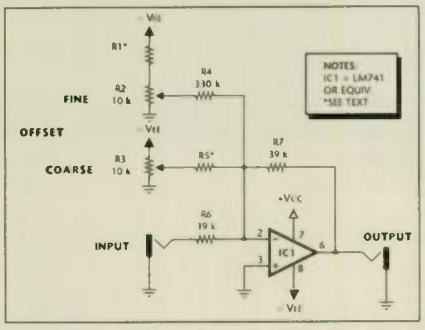


FIG. 1: Keyboard control-voltage inverter.

the table in Fig. 2 to select the values for R1 and R5 that will work with the power-supply voltages in your system.

Fine and coarse tuning controls, R2 and R3, respectively, should be set to yield a voltage, measured at the op amp inverting input, that is equal to the full-scale output of the controller. For example, a five-octave keyboard would require an offset of 5 volts, a four-octave keyboard requires an offset of 4 volts, and so on. Full scale voltage = (number of keys - 1) x 1/12th volt. To calibrate, set R2 at midposition. Monitor the op amp output with a DVM and approximately adjust R3. Fine tune R2 by ear.

SUPPLY VOLTAGE	±15	±12	±10	±9
R1	100k	75k	62k	56k
R5	110k	91k	75k	68k

FIG. 2: Resistor values vs. supply voltage.

Of course, many modular and quasi-modular synths have onboard variable-voltage sources and CV inverters. In this case, no external circuitry is needed.

Q. I want to control the volume of my Akai S1000 sampler from the footpedal of my Casio FZ-1. The S1000 supposedly responds to MIDI volume—when I move the FZ pedal, it seems to be getting data—but nothing happens. How can I get it to work?

A. MIDI protocol specifies controller number 7 as "Main Volume." The FZ-1 transmits pedal motion as controller number 4, "Foot Controller," but the S1000 receives only controller 7 for volume control (the FZ-1 also receives, but does not send, controller 7). Unfortunately, there's no way to program either instrument to send or receive the desired data. Perhaps the simplest solution is to use an external volume pedal. Aside: the Yamaha DX7 transmits pedal motion as controller 7, so it would work with your setup.

Q. One of the buttons on my Casio CZ-101 sticks and sometimes doesn't work. How can I fix it?

A. The CZ panel buttons actuate membrane switches. If the switches become worn, the buttons may feel sluggish or "stick." Membrane switches come in multicontact strips; replacing a strip requires complete disassembly of the CZ-101. Unless you're really up on synth repairs, leave this to a qualified tech.

Sometimes contamination around a button will cause it to stick. Spraying a little Freon/silicon at it might help (try Radio Shack's TV Tuner & Control Cleaner & Lubricant, catalog number 64-2315); it certainly won't hurt. But don't use too much or you'll get slime all over your keyboard.

Q. Is it possible to drive two MIDI inputs from one output by making a MIDI "Y"

cable? I have a small setup—one keyboard and two modules (no thru jacks)—and a MIDI thru box with a zillion jacks is overkill.

A. It can be done, and it works, though it's very out of spec. The trick is to wire the Y in *series*, as shown in **Fig. 3**, rather than in parallel. This is important, because many instruments—e.g., the Casio CZ-101 and Yamaha DX7—use low-power Schottky (LS) TTL gates to drive the MIDI output, rather than the heftier TTL buffers recommended in the MIDI specification. Standard LS TTL gates can sink only 8 milliamperes; two parallel MIDI inputs exceed this. I've tried the series scheme with various instruments and had no problems. Just use low-capacitance cable and keep the length as short as possible. Note: do *not* attempt to use this method to connect two outputs to one input.

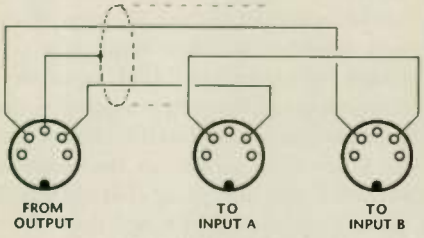


FIG. 3: MIDI Y-cable, series-connected.

At least one commercial device works this way: the 1-2 MIDI cable (reviewed in the September 1987 **EM**), from Micro-W Distributing, 1342-B Route 23, Butler, NJ 07405; tel. (201) 838-9027.

Q. Where can I obtain technical information on the NEC μPD-7811 microprocessor, used in the CZ-101/1000 and other synths?

A. The μPD-7811 is a full-featured 8/16-bit microcomputer-on-a-chip, with on-board ROM and RAM, five programmable ports, a full-duplex USART, an 8-channel/8-input A/D converter, two programmable 8-bit timers, a programmable 16-bit counter/timer, and other nifty stuff. It's covered in detail in the *NEC μPD-7810/7811 User's Manual*, which bona fide techno types can order, at no charge, via NEC's toll-free literature request line: tel. (800) 632-3531.

Alan Gary Campbell *is owner of Musitech,™ a consulting firm specializing in electronic music-product design, service, and modification. He's working on a method to invert the response of his economic profile.*

FIRST TAKE: Capsule Comments

Our May mélange includes mini MIDI manipulators, reference tones on CD, an interactive composition program, and the ultimate scale sourcebook.

CR KNG

All 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" surpassses 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.

the EM rating system

Anatek Pocket MIDI Accessories ($99 each)

By Craig Anderton

The Pocket Products line of MIDI accessories (Pocket Filter, Pocket Merge, and Pocket Pedal) feature small size (3.2 x 2.1 x 1.2-inch) and a status LED that turns off when any MIDI data other than real-time data passes through the unit. They draw their power via the MIDI line and require no batteries or AC adapter. The LED also indicates MIDI error or overload conditions by turning off and staying off, in which case you need to reset the unit by unplugging the MIDI in cable. In all my testing, though, I never needed to reset any of the boxes.

The Pocket Filter filters your choice of aftertouch (poly or channel), continuous controllers (all controllers are filtered out; you can't choose specific ones), pitch bend, program change, all channel data (system messages are not filtered), note events (both on and off), system exclusive/common messages (real-time messages are not filtered), and system real-time messages. You can select any or all of the above via an 8-position, DIP switch on top of the unit and can filter data out of all channels or, where appropriate, any selected channels. Channel selection requires a keyboard or equivalent MIDI controller: you turn on all the switches and play the keys that correspond to the channels to be filtered, as shown on the diagram included with the short (but clear and useful) instructions. I tested the Pocket Filter using Ralph Muha's excellent *MIDIScope* program and confirmed that the box does exactly what Anatek says it does. By the way, the Filter also internally generates active sensing data.

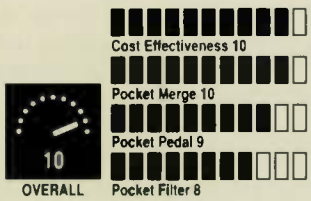
The Pocket Merge is a basic, 2-in, 1-out, MIDI data merger. The question with mergers is how much data they'll accept before they overload, so I tried feeding progressively more complex data streams into the unit. For the final test, I fed about nine channels' worth of dense, sequenced material into one input and the output from a MIDI guitar, in mono mode, doing outrageous amounts of pitch-bending, into the other input. Amazingly enough, the thing *still* didn't choke. This is a great box that really makes MIDI merging affordable. It's also just the ticket for programming a rack-mount device with editor/librarian software and feeding the rack with both the computer's MIDI out and a keyboard: the merger had no problem handling any system exclusive data I threw at it. Every studio should have a MIDI merger available, and I suspect quite a few studios will choose this one for its low cost and ease of use.

Pocket Pedal translates the motion from a standard, resistance-based, volume pedal to four types of MIDI output messages: volume, pitch bend, modulation, and portamento time. These appear on any number of channels, se-

lected in a manner similar to channel selection for the Pocket Filter. A second jack accepts a footswitch that can be set to provide sustain, sostenuto, start/stop, or portamento on/off. The four footswitch and four pedal options are set with a DIP switch.

The box includes an auto-calibration routine that calibrates your pedal when you plug it in, so the pedal will generate the full range of MIDI values—very hip. What's more, you can also calibrate a reverse curve (i.e., pushing the pedal down goes from maximum to minimum value), and pitch bend can be calibrated in one of three ways (full-range, bend up to normal pitch, or bend down from normal pitch). You can't choose different pedal response curves except reverse, but considering what this box does provide, it seems almost ungrateful to point this out.

These are great little units. The price is right, the features useful, and they don't take up a lot of space. I bought the Pocket Merge as soon as I finished testing it, and the Pocket Pedal fills a need for those musicians who need real-time control over the most common MIDI controllers. The Pocket Filter may be the least useful of the three, because many devices (such as sequencers) already include filters, and you can't just filter out one controller (like the infamous all-notes-off command, which can cause real problems when merging signals together). Still, it does work as advertised. My only caution: don't lose the single-sheet instructions, because the instructions are the only way you'll find out about some of the units' strongest points. Thumbs up to Anatek on their first foray into the world of MIDI accessories.



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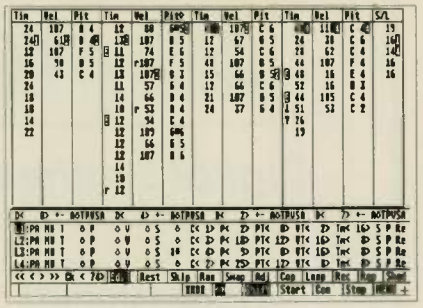
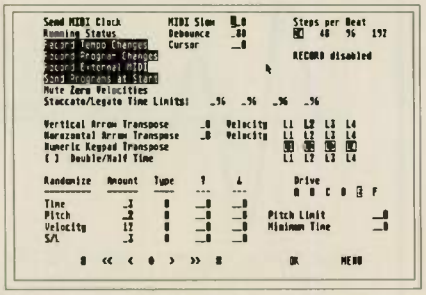




Dr. T's Fingers for the Atari ST ($79)

By David Snow

The democratization of musical technology continues with *Fingers*, a self-described "musical computer game" for the Atari ST. The description is misleading, however, since the program is really a composition/performance tool. Fingers author Emile Tobenfeld (Dr. T) conceived of the program as an interactive instrument that would permit any aspiring composer, no matter how maladroit or tin-eared, to create interesting music with the computer keyboard and a mouse (a MIDI synth isn't necessary, as Fingers can play the ST's sound chip).

You use Fingers by inputting several series of values specifying pitch, time (rhythm), velocity, and articulation; upon playback, this data controls the output of four independent, monophonic melody lines. If the series are of different lengths, their cycling creates complex patterns as they go in and out of phase.

You can also change the contents of the series and redirect the program's movement through the series in real time, inserting randomizing elements that mutate selected values at each pass, and having the program loop or skip elements. Each of the four lines can be independently muted, paused, transposed, time-shifted, time-scaled, and velocity-scaled, and you can change MIDI channel and program assignments on the fly. All this adds up to an infinitely variable range of possibilities, despite the program's deceptively simple premise.

Fingers has much the same look and feel as Dr. T's *Keyboard Controlled Sequencer* and is compatible with KCS's *Multi Program Environment* (MPE), Dr. T's program-switcher that allows compatible programs to simultaneously reside in memory for instant access. (*When Fingers is used with MPE, compositions can be saved automatically into KCS. Also, sections from KCS sequences can be loaded into Fingers.—Ed.*)

Fingers' user interface is logical but not self-evident; I actually had to *read the manual* before I could start diddling in earnest. Monochrome ST users may be put off by references to color-coded, onscreen buttons, but the layout quickly begins to make sense. After you've entered pitch and velocity values by typing or playing a MIDI keyboard, click on start, and you're off, controlling the program with the ST keyboard and mouse, or the mouse alone.

A range of global options are also settable (though not during performance), including MIDI operations, clock resolution, recording switches, randomization limits, and the number and type of parameter series. The interactive nature of the program makes it appropriate for live performance as well as composition, but as with any instrument, only practice brings fluency and predictability. In particular, some key/mouse combinations are easy to forget, and mouse positioning must be done carefully.

Using Fingers successfully also means thinking "macro" rather than "micro"; that is, in terms of controlling the direction of the process rather than note-to-note relationships (the latter is fairly impossible once things start getting complex). It's helpful to have a strategy or a concept of form before you begin to play, and to install some of the program's Shadow parameter values (alternate parameter values that can be invoked on the fly to add controlled contrast to a piece). Either that, or you can have yourself a good freak-out.

You can save Fingers' MIDI output to disk, in KCS file format, for editing and processing in KCS, giving you a versatile composing environment, courtesy of the two programs' diverse approaches to music construction.

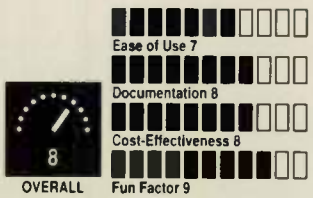
Jim Johnson's loose-leaf manual is lucid and well organized, but a summary of mouse/key commands would be a welcome addition. The copy-protected program disk contains sample parameter files created by the program's author and Johnson, which range in style from tonal, rhythmic grooves to slowly evolving, arhythmic sound clouds.

How a user exploits Fingers depends very much upon his or her conceptual framework. A traditional music background isn't necessarily an advantage, and it could even inhibit certain types of experimentation. However, it's fair to warn potential Fingers users that they may fall victim to the dreaded "Pinhead Syndrome," a malady in which one becomes so involved in the minutiae of the creative process that one becomes obsessed with details nobody else hears or cares about. So spare your loved ones, and remember that in reckless hands, Fingers can crank out endless reams of sound that interest no one but the composer.

As a composer with a linear, "track mode" mind, I found Fingers a valuable means to explore new modes of musical thought. Its ability to save performances as KCS files and its integration into the Multi Program Environment enhance its usefulness as a compositional tool.

The program is inexpensive, fun, and fairly easy to use. But a computer game? Well, when the planets are in proper alignment, it can create a thing of beauty.

David Snow's *music has been premiered by the Composer's Chamber Orchestra, the Harvard Wind Ensemble, the Ruby Shang Dance Company, and the Los Angeles Tuba Quartet.*



Dr. T's Music Software
220 Boylston St. #206
Chestnut Hill, MA 02167
tel. (617) 244-6954

Prosonus Studio Reference Disc ($49.95)

By George Petersen

Having already taken the audio industry by storm with its critically acclaimed, sampling library compact discs and innovative CodeDisc (one hour of SMPTE time code on a compact disc), Prosonus now debuts the Studio Reference Disc, a CD containing just about every test tone you'll ever need.

An invaluable aid to the technician, electronic musician, studio engineer, or sound-reinforcement professional, SRD is a complete audio toolkit on a CD. With a running time of nearly 70 minutes, SRD is packed with useful tones: white noise, pink noise, pink noise and sine wave bursts in third-octaves, 30- to 60-second sine waves in seventeen bands from 15.525 Hz to 16.0 kHz, the Caveat Header (a 50-second series of standard audio test tones often used on the heads of videotapes and synchronized audio tracks), Techron TEF and ETC test

sweeps, tones from Acoustic Sciences Corp.'s Music Articulation Test Tape,™ Northwestern University's LEDR™ psychoacoustical perception test bands, speaker phasing checks, and a variety of musical pitch references. The latter include A-440, A-442, A-444, and octaves of A3 (220 Hz) to A4 (440 Hz), presented both as sawtooth waves and piano notes.

SRD also provides some nifty little touches, such as Band 53, a left/right channel test presented as a 30-second, digital recording of an Amtrak passenger train approaching and passing from left to right. And speaking of digital recording, SRD was produced completely in the digital domain, directly into a Sony PCM-1630 processor.

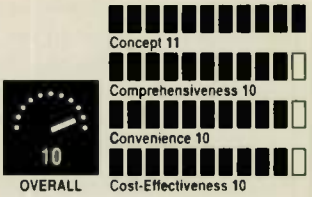
SRD also makes clever use of the compact disc medium. Getting right to the sound you need is simple: punch in the track number you need, and your CD player is instantly transformed into a multifunction test generator. You can access tracks quickly (I loved using the SRD with a wireless remote), play them back in any order, or set one for endless repeat using the programmed play features found on most CD players.

The best aspect of the SRD is its comprehensiveness. Even if you don't know what to do with TEF (Time-Energy-Frequency) sweeps, you just might need them someday. I have a feeling that CD and record mastering engineers around the world may applaud the fact that SRD includes one-minute 100, 1,000, and 10,000 Hz tones; in fact, these appear twice on the disc. With an inexpensive tool like SRD available, you no longer have any excuses for sending out a tape without these important signals recorded at the head.

Prosonus took a great deal of care in producing the Studio Reference Disc and did its homework well on this project, having consulted a lengthy panel of experts in researching which test signals to include. The accompanying booklet is excellent, offering plenty of applications notes for the test signals and even a bibliography of recommended reading. At $49.95, SRD may be one of your best audio investments in 1989.

Also available through EM Bookshelf: (800) 233-9604.

George Peterson *lives with his wife and two musical dogs in a 100-year-old Victorian house on an island in San Francisco Bay.*



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The Scale-Chord Synopticon ($29.95)

By Steve Oppenheimer

The aptly named *Synopticon* by Kathlyn Powell, John Fowler, and Jorge Strunz—a 634-page, computer-generated book of tables with explanatory text—identifies, classifies, and cross-references all the 274 unique, 5- to 9-note scales that are possible in the 12-tone system and the 336 distinct chord types that can be derived from them.

The authors have created a deep system that, once fathomed, makes the scales and chords accessible and the relationships among them understandable. The scales are organized by type, which is defined by the number of notes per scale, from pentatonic to nonatonic. Within each type, the scales are numbered. For example, the third of the 66 heptatonic (7-note) scales—better known as the major (Ionian) scale—is named "7-3." Modes are accounted for but are not listed individually, as they are not "unique." The Phrygian mode, for instance, is scale 7-3-3 (i.e., the third

mode of scale 7-3). All scales get an overall sequence number, from 1 to 274, for cross-referencing.

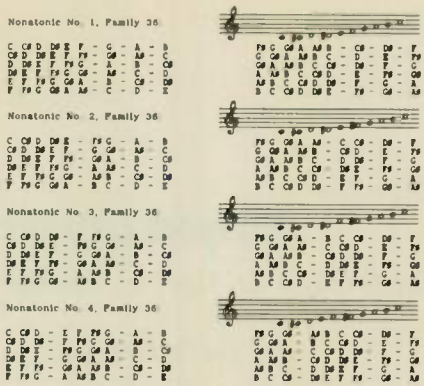
The scales are grouped in families, defined by the intervals comprising them; all scales in family 133, which includes the harmonic minor, contain one minor third, three major seconds, and three minor seconds. A graphic representation of each scale's intervallic structure helps clarify the relationships within and between families.

The second table lists the note names of each scale, transposed into all twelve keys, and depicts each scale in standard notation, in the key of C. Note naming is nonstandard, however, as the authors do not use flats and avoid enharmonic spellings (such as E# and double sharps). In the *Synopticon*, scale 7-6, for example, in C is: C, D, D#, E, F#, G#, and B. There are two "D" notes and no "A." Conventionally, this scale is: C, D, Eb, Fb, Gb, Ab, and B; each scale degree is assigned a unique note name. The authors opted for a system that could remain consistent for all scales (including eight- and nine-note scales, which require note-name repetition). Theoretical quibbles aside, this system takes getting used to but is not a major hassle.

Chord types are divided into nine groups—major, minor, dominant, etc.—and assigned an overall sequence number. Again, there are intentional naming differences: a maj9 chord indicates what is usually called a major7(9); a major triad with a ninth but no seventh—commonly a maj9—is a maj/9, the slash indicating the absence of the seventh. The authors use elevenths in some places to accommodate traditional chord names, but fourths are used in cross-referencing to keep within one octave. The authors wisely shun the issue of alternative chord voicings; to do otherwise would consume enough paper to lay waste the forests of California.

As with scales, pictorial representations of the chord types' intervallic structures are included. A table shows the names of the notes comprising each chord type, transposed into twelve keys, and also displays each type in standard notation, in the key of C (with flats, but not enharmonic spellings).

Next, the chords are related to their scale equivalents, the scales that contain all the notes in each chord. A list of chords contained in each scale is supplied, with the scale degree on which each chord occurs. The table shows, for instance, that in the major scale (7-3-1), dom7sus4 chords occur on the second, third, fifth, and sixth scale degrees. A list of scales containing each chord type completes the second section of the book.

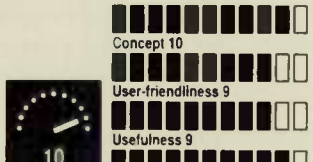


Excerpt from Synopticon's the scale transposition table

The last major section of the *Synopticon* correlates subsets and supersets. That is, the subset of an octatonic (8-note) scale is comprised of all the heptatonic scales it includes. The superset of a scale includes all the scales, larger by one note, that contain it. Although the tables only show sets of related scales one note larger and smaller, more distant relationships can be traced in successive, single-note steps.

Four appendices offer clarification. One lists the scales by *Synopticon* number, with their common, international names, then shows the same information alphabetized by international name. The other appendices discuss the computer algorithms used to devise the *Synopticon*, the quantities of each scale and chord type, and an efficient method of locating a given scale.

The terminology and organization of the book takes some getting used to. However, once the tables are understood, *The Scale-Chord Synopticon* offers a useful reference as comprehensive as its name implies.



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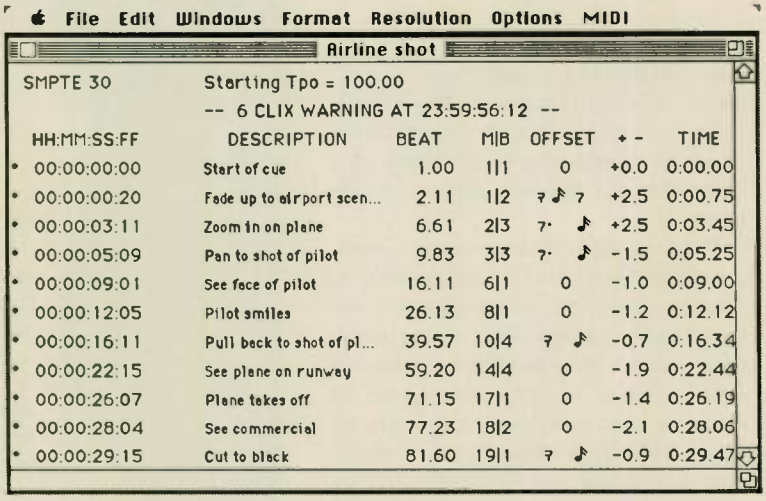
Passport Designs ClickTracks 2.0

Music for the movies is bigger than ever. Here's a new way to get your MIDI studio into the scene.

By Paul D. Lehrman



The Hitlist shows cues, their locations, and other information.

MIDI has changed the music-for-visuals market so drastically that a reported 70% of the TV or radio commercial jingles composed in this country are being done in home studios. It's the dream of many, if not most, home studio owners to be involved in scoring films and TV shows. The software providers have been doing their part to help us realize that dream, and the last couple of years have seen the emergence of music software specifically designed for the composer or music editor working with film and video. These programs are not for hobbyists; they cost serious bucks and require substantial amounts of hardware to be effective. But we're talking about a major glamour business, and the programs are commanding a lot of attention.

Two of the major players in Macintosh music software have already joined the fray. Digidesign's *Q-Sheet* (reviewed in the May '88 EM) is a "non-musical" sequencer designed to facilitate the use of MIDI for sound effects and studio automation. Opcode's *Cue* (October '88 EM) assists the film composer in numerous ways, including automating the process of finding musical placements of visual "hits," streamlining a lot of paperwork.

Now Passport Designs has released the latest version of *ClickTracks*, written by New York composer Bruce Coughlin. ClickTracks has actually been around since the fall of 1986 as a simple program written in Microsoft BASIC and uploaded to PAN as shareware. It received a very positive response (it's still on PAN), and in the months that followed, in the best tradition of public computer networks, several users contributed ideas for new features. Soon Coughlin had the program in standalone form and was selling it commercially through a handful of dealers. In late 1987, Passport picked up its distribution and worked with Coughlin to improve it.

Today, ClickTracks provides a number of valuable services. Its two main functions make the more mundane mathematical chores of film composing much easier: a clickbook and a sophisticated method of locating hits.

THE CLICKBOOK

The Clickbook is the simplest part of the program. It displays a window containing the timings of the first 600 beats of a piece, at any chosen tempo, expressed in either beats per minute (bpm) to the nearest hundredth, or in frames per beat to the nearest tenth of a frame. The timings can then be shown in any of the standard film (frames or feet/frames) or video (hours/minutes/seconds/frames) formats. Unlike a traditional clickbook, the zero point can be offset to any value, so you can use the screen to calculate the *actual* times of the beats in a real cue, not just the relative times from the start of the cue.

THE HITLIST

The program's main window is the Hitlist, where visual events requiring a musical change or accent—known as "hits"—are listed and edited. You specify an initial tempo and enter and name the hits, one at a time. The hits can come from a film's editor or a workprint (preferably one with a time code window "burned in" to the screen), and can be entered in any film or video format. (Formats can be changed at will, and the list will be automatically recalculated.)

As each hit is entered, the program calculates on which beat it falls and, if it is off the beat, by how much, in subdivisions of both beat and frame. The subdivisions are user-selectable, so the display can show hit locations to the nearest eighth note, sixteenth, eighth-note triplet, etc., and it uses musical notation, not just numbers. The display can show a hit's location in either total number of beats from the beginning of a cue, or in measures and beats, referred to a user-specifiable time signature.

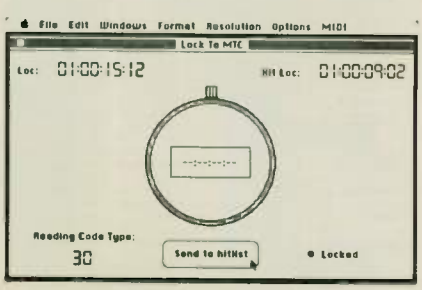
If you change the tempo, the relationship of the hits to the beats will change as well. The Scan feature lets you select a range of tempos, e.g., from 110 to 130 bpm (in whole numbers only) and will calculate how many hits fall close to beats at each tempo, giving you a "score" for each one. The definition of how close is close enough is up to the user. You can also specify a range of offsets for the starting point, so you can compare the score of a cue at 121 bpm that starts three frames late with the score of a cue at 123 bpm that starts four frames early. You can make some hits more important than others, or scan only certain parts of a cue by using a hide function on the hits you want to ignore.

Once you decide on a tempo you like, you can insert it on any beat. Time-signature changes can also be inserted on any measure boundary. These changes become part of the Hitlist and can also be viewed by themselves and edited in a Conductor window.

Two features new to this revision are Accel/Rit and Make It Fit, which will calculate accelerandos or ritards over a particular time span to bring hits into line. You specify a starting point for the tempo change, then tell the program either that you want a certain beat to line up with a specific time or hit, or that you want a certain tempo to be reached by a specific point in time.

Another new feature is the ability to insert and delete time in a Hitlist, shifting all the hits after the insert/delete point accordingly. This can be of great help when a film is still in the editing stage, and a scene is shortened or lengthened while the composer is in the thick of assembling the score.

The Hitlist can be displayed in a graphic form, known as a "Hitmap," which is similar to music notation and can be printed out to serve as a skeleton score for conducting live musicians.



The Stopwatch spots cue points and generates a Hitlist.

• CLICKTRACKS

MIDI FILES

ClickTracks would just be a fancy calculator if it couldn't export a Hitlist as a Standard MIDI File (see the April '89 EM) so a compatible sequencer can use it as the structural outline of an entire piece of soundtrack music. ClickTracks supports both Type 0 and Type 1 MIDI Files. All tempo and meter changes stay intact when the Hitlist is imported into the sequencer, and the names of the hits are retained as markers. This function also works the other way around: you can save a piece in a sequencer, with its tempos, meters, and cue markings, as a MIDI File and import it into ClickTracks as a Hitlist.

In a Mac with plenty of memory, using ClickTracks and Passport's *Master Tracks Pro* sequencer simultaneously under MultiFinder is a breathtaking experience, especially when using the sequencer with MIDI Time Code. You construct the hit list, send it over as a Conductor track (which contains tempo and meter changes), record your musical tracks, and play it back locked to a SMPTE track on your video. Everything is right where it's supposed to be, the first time.

A PROBLEM

There is one slight problem interfacing these two programs, however: ClickTracks will work with fractional tempos but allows changes only on beats, while Master Tracks Pro will only recognize whole-number tempos, although with no restrictions on where they occur. If you remember to stick to whole-number tempo changes on whole beats when you're sending a MIDI File back and forth, the exchange is flawless, but if you don't, some rounding-off will occur, and that could throw some of the hits off.

It's also unfortunate that Master Tracks Pro does not let you import a Conductor track into a pre-existing sequence, so it's difficult to write the music first and lay the tempos in later. There is a way to do it—put the entire sequence on the Clipboard, select New, import the MIDI File, and then paste the Clipboard into this new sequence—but it's clumsy and requires a lot of memory. Perhaps Passport can do something about this in a future version of the sequencer.

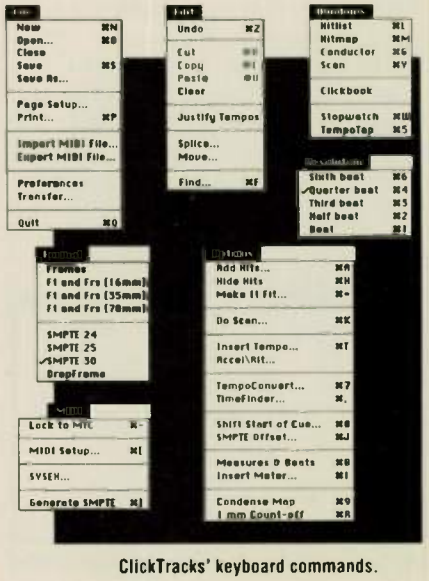
If you're not using MIDI Time Code yet, you can export tempo and meter information from a Hitlist to a SMPTE-to-MIDI clock-and-pointer converter, like the Roland SBX-80 or Jam Box, using system exclusive data. This makes it unnecessary to program the converter by hand, which can be a very tedious job in a file with many tempo changes.

WATCHES AND TEMPOS

Two other features add to ClickTracks' effectiveness. A Stopwatch function not only allows you to time the difference between two events, it lets you construct a Hitlist from visual cues, in real time, which you might have to do when you've been given a workprint that has no time code window. Tap the Return key at the beginning of a cue, and each time you hit the space bar, the computer records the elapsed time and adds it to the Hitlist. The function can work either with the Mac's internal clock, or locked to incoming MIDI Time Code, in which case the numbers it generates are real SMPTE times, not just relative times.

The other function is Tempo Tap, which can help you when you've got a "feel" for the tempo of a musical cue but have no idea what the numerical value is. Hit the space bar five times, and ClickTracks tells you the tempo (in beats per minute and frames per second), based on the average time between taps.

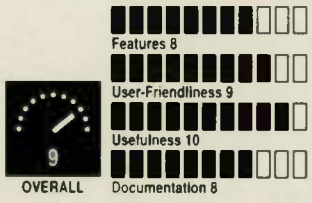
Anyone familiar with Cue will recognize that ClickTracks covers much the same ground as Opcode's program, so comparisons are inevitable. While Cue has more features and presents some of ClickTracks' functions with a little more sophistication, ClickTracks has its edge,



ClickTracks' keyboard commands.

Product Summary

PRODUCT:
Passport Designs ClickTracks V. 2.0
TYPE:
Film-scoring software
PRICE:
$495
HARDWARE REQUIREMENTS:
Macintosh 512KE, Plus, SE, or II; printer, MIDI interface, and SMPTE-to-MIDI or SMPTE-to-MIDI Time Code converter recommended
MANUFACTURER:
Passport Designs
625 Miramontes Street, Suite 103
Half Moon Bay, CA 94019
tel. (415) 726-0280



too. It's less expensive (although until Passport recently increased the price, it used to be a *lot* cheaper), and, more important for the beginning or part-time film composer, it's somewhat less daunting to get started on and more forgiving in use. For example, you don't have to worry about naming and organizing files, the way you do in Cue, to use many of the more advanced features. ClickTracks is highly intuitive, and the new, 84-page manual is perfectly adequate.

Of course, either program would have seemed miraculous just three years ago. Today, faced with this choice, I feel that Cue is more appropriate for the experienced, heavy-duty professional, while ClickTracks will perform more than enough miracles for the beginning or part-time film composer to justify its price.

(A Version 2.0 upgrade is available to owners of previous versions.—Ed.)

Paul D. Lehrman *composes music, writes articles, teaches computer-music literacy, consults with various hardware and software manufacturers, goes to trade shows, and grumbles and complains a lot, but he's a lot happier than he looks.*

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Miller/Blake Sample Disks for the Kurzweil 250

The wait is over—Kurzweil K250 owners now can expand their libraries with this new family of disk-based samples.

By Chris Yavelow

As we approach the fifth birthday of the Kurzweil 250, the first commercial, disk-based sample library for the instrument has finally appeared. Miller/Blake Samples, a company that has been marketing a Prophet-2000 sample library since 1986, has produced a catalog of 96 Macintosh disks full of samples for the K250.

Although reasonable facsimiles of the Kurzweil ROM-resident samples have turned up in the libraries of nearly every one of its competitors, until now, the only disk-based samples for the K250 have been those available from Kurzweil Music Systems and a sample clearing-house run by Sweetwater Sound. It takes about one second to realize that Kurzweil Music Systems has no motivation to include anything in its disk-based library that would compete with the samples in its own ROM blocks, as the sale of the these four soundblock options is one of its major sources of income.

The orientation of Sweetwater Sound's K250 sample library is along the lines of a "sample swap meet" (send a disk of samples as a contribution to the library and get any disk in return). Sweetwater's best sounds are reserved for their own ROM-based, K250 samples, which are available to plug into your SGP board, or in cartridge form for the Version 6.0 cartridge slot.

The Miller/Blake catalog states that their samples "complement and, in many cases, improve upon the resident Kurzweil ROM samples." For the most part, this statement is accurate. In the past four years, I have listened to nearly every K250 digitizer bank (group of sound files) floating around the bitstream, and the Miller/Blake samples are definitely in the upper echelon. However, I should stress that my opinion is based not on their complete 96-disk library, but on the 29 disks the company sent for evaluation.

The disks are distributed as follows: 21 guitars and bass guitars, sixteen woodwinds and saxes, eight brass, six percussion, twenty synths and keyboards, six vocals, eleven strings, and eight miscellaneous disks (harmonica, mandolin, accordion, big band, and orchestral tutti). The strings are the only orchestral section that is completely represented: there are many violins, violas, cellos, and an excellent double bass. The wind disks are heavy with flutes and saxes but missing the oboe, clarinet, and bassoon. An English horn and a disk of recorders are listed in the catalog, but I didn't get to hear these. The brass disks are mainly trumpets and a flugelhorn. Most of the disks come with keyboard setup files that combine Miller/Blake's sounds with the ROM-resident ones.

Seven of the disks use an approach that's becoming more and more fashionable, that of sampling an entire ensemble: "Big Band One" (three saxes, four trumpets, two trombones), "Wind Ensemble One" (three flutes, two oboes, two clarinets, one bassoon), "Trumpets and Trombones One" (three trumpets, two trombones), "Bright Brass One," "Big Band Two," "Trumpet Section," and "Full Orchestra One." The advantage is that the interaction of groups of instruments, sampled *en masse*, will always be more realistic than a layering of instruments sampled separately. Additionally, single notes of these combos count as a single note on the K250, helping optimize its channel-stealing.

Recordings were made with three mics: a Sennheiser 421, an Audio-Technica ATM-33R, and an Electro-Voice NDYM 757. Although the K250 will sample at rates up to 50 kHz, the vast

majority of these sounds were sampled at 31.25 kHz to conserve memory. The Kurzweil digitizer's de-emphasis modes were used for most of the sustained sounds, and these were looped internally or with Digidesign's *Sound Designer*, which is compatible with the K250 via Kurzweil's soundfile conversion utility, *SD Convert*. Percussive sounds were sampled using the Kurzweil's compression modes. Soundfile volume was adjusted by turning off the K250's velocity sensitivity and then running the roots through a Tascam VU meter for comparison. Jim Miller (not the same Jim Miller of *Personal Composer* fame) also took psychoacoustic phenomena into consideration when adjusting soundfile volume: higher notes tend to sound louder if they are, in fact, at decibel levels identical to lower notes.

Samples are personal things. Many of the people for whom I played these samples loved the ones that disappointed me and vice versa. Nonetheless, sixteen sounds got unanimous "excellent" ratings from all of us: "Acoustic Six String Steel Guitar" (disk 1), "Baritone Sax One" (disk 15), "Pan Flute One" (disk 16), "Electric Grand—Yamaha CP70" (disk 17), "Solo Violin Two" (disk 21), "Double Bass One" (disk 31), "Female Vocal Two" (disk 32), "Solo Flute One" (disk 35), "Muted Strat/Funk Strat" (disk 36), "Solo Cello Two" (disk 37), "Alto Sax Two " (disk 42), "Soprano Sax One" (disk 43), "Solo Trumpet One" (disk 45), "Solo Violin Four" (disk 51; this goes higher than the ROM violin in Sound Block C, also known as the "Classic Block"), "Solo Viola One" (disk 72), and "Baritone Sax Two (disk 78). Excellent, too, were most of the sampled synths (but synths are relatively easy to sample; the live instruments here will save you time and money).

I encountered isolated cases of aliasing and inconsistent decay loops, but in many cases, you could edit these yourself once you've loaded the sounds into your K250. Should you notice an out-of-tune note or a poor loop, Miller/Blake promises a free upgrade as newer versions of those disks are created. My main complaint with the Miller/Blake library is the organization of their catalog. For example, violins 1 through 5 are on disks 20, 21, 47, 49, and 79, respectively, and that's a minor nuisance.

One of the best aspects of their libraries is you can mix and match their sounds into ten-disk sets for $139.95 per set (compare that to Kurzweil's sound libraries that list for $150 per ten-disk set and don't let you substitute disks between sets). Miller/Blake's prices go down 10% if you order two sets at a time and 15% if you get three. There is a demo cassette recording available for $6.50. The company is committed to producing new K250 disks on a monthly basis. They publish a bimonthly newsletter to keep users up-to-date.

If you own a Kurzweil 250, you would be well-advised to order the Miller/Blake demo cassette and catalog. If you want to jump right in and are willing to trust my ears, you wouldn't go wrong picking a set of ten from the disks containing the sounds I consider excellent (greater than nine on a scale of one to ten). At this time, the Miller/Blake Kurzweil 250 Sample Disks have no competition. Fortunately, the company has very high standards.

(Miller/Blake donates half of all profits from the sale of its sample disks to the World Wildlife Fund, the ASPCA, and the Humane Society.—Ed.)

Chris Yavelow *is a computer-assisted composer who sampled his daughter's birth cry in lieu of taking those boring photographs your friends usually make you look at.*

Product Summary

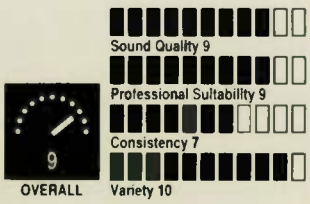
PRODUCT:
Kurzweil 250 Sample Disks for the Macintosh

TYPE:
Pre-recorded sample disks

MANUFACTURER:
Miller/Blake Digital Samples
2801 18th Avenue
Sacramento, CA 95820
tel. (916) 452-7685, 6 p.m. to 11 p.m.

LIST PRICE:
Set of ten disks: $139.95; two sets of 10 disks: $125.95 per set; three sets of 10 disks: $118.95 per set

EQUIPMENT REQUIREMENTS:
Mac 512KE or better, Kurzweil 250



Roland R-8 Human Rhythm Composer

The company that put the drum machine on the map has redefined what a drum machine is all about—with truly groundbreaking results.

By Lory Kohn

C R KING

The R-8 Human Rhythm Composer comes to the ball clad in a surprisingly austere casing. Its sedate, stylish design hardly seems calculated to attract rappers. Beneath that Brooks Brothers exterior however, lies a dynamo ready to suck in its belly, stick out its chest, and salute. Efrain Toro has programmed it to do just that: his "Jungle," included as Demo Song 0, is the hottest demonstration I've ever heard for an electronic device. But there's a lot more to the R-8 than one spectacular demo.

THE MANUAL

The 230-page manual is written in Roland's proprietary Japo-Saxon. It really tries hard, and its length represents a rare commitment to the user. I appreciate the extensive index, brief (but useful) appendix, and troubleshooting section; when I had problems, I could find answers. Roland also includes a handy, quick, operation guide and the latest revision of its *MIDI Guidebook*.

Although every operation is carefully described, the manual's most inscrutable parts deal with the machine's most innovative features, and there are few hints offered as to what real-world applications (of which there are many) best suit each feature. The same can be said for the manual's 16-page MIDI section.

Obviously, the R-8 has been stocked with a veritable *Kama Sutra* of sexy MIDI capabilities, but it's up to you to figure out what you can do with them. But hey, you're a MIDI musician; you're used to being one of the bold explorers venturing into the unknown. Despite occasional shortcomings, the manual is a milestone in the often sordid history of technical writing.

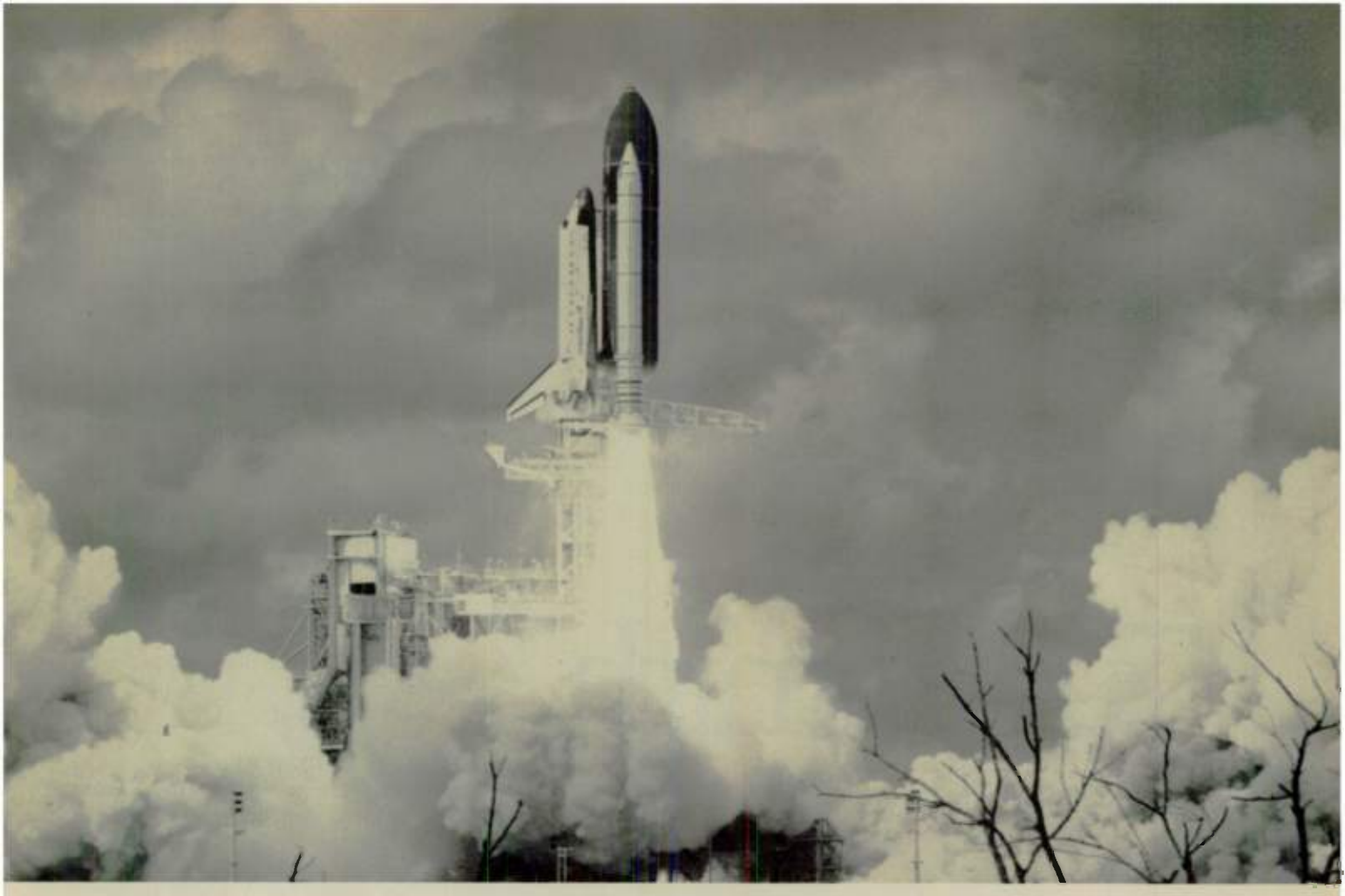
GOIN' TO AGOGO

Ah, the lush unknown. Experiencing these dynamically allocated sounds, sampled at 44.1 kHz with 16-bit dynamic range, is like being in a rainforest hearing the calls of tropical birds and the pounding of native drums. The sound quality is similar to the Alesis HR-16, except there are over twice as many sounds, you can edit them in real time, and the toms sound a lot more aggressive. There are 68 invigorating factory sounds and room for 26 edited versions of those 68; optional RAM/ROM cards can provide another 26 sounds. You feel the skin and gristle of the drums and the clang of the cymbals. Do eight kicks, fifteen snare variations, and a pedal-closed hi-hat whet your appetite?

The R-8 gives you three powerhouse sets of four matched toms with "Doom Tom" thrown in for good measure. The percussion lineup includes can, clave, cabasa, cowbell, four congas (including slap, slide, and mute), tambourine, taiko, shaker, agogo, wood block, and pipe. Bell and ride cymbals are especially clear and metallic (the ethereal sounds heard on the demo are "pipe" variations). A nice touch is the rest included as instrument 68, which lets you do tricks such as ending a song by "grabbing" your crash cymbal with your rest. The first ROM card, as yet unreleased, is rumored to include brush snare and acoustic basses. I guess ROM wasn't built in a day. (*I've heard the brush snare ROM cartridge, and it's every bit as good as the other drum sounds—Ed.*)

KIT FLEXIBILITY

Five sets of Pad Banks await your instrument assignments, but you can save and load an unlimited number of kits through system exclusive commands. The wonder of kit assembly is you can program velocity, pan, eight different velocity curves, decay, nuance (explained below), and other assignments, in real time. Parameter changes do not have to be accompanied by tapping the enter switch; this machine gives you credit for being able to make decisions without getting freaked that maybe you



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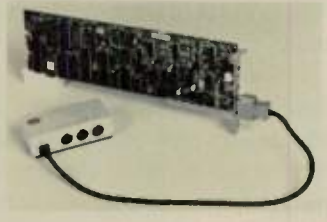

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did something you didn't want to do. Only if you want to perform more major surgery, such as inserting a part into a song, do you have to hit Enter as a precaution.

BASIC OPERATION

To get around the R-8, you first have to select one of its six basic modes—Song, Pattern, MIDI, Instrument Assign, Card, and Utility—each with its own button. Pressing any of these mode buttons calls up numbered submenu items in the LCD. For example, selecting the Play submenu from the Pattern menu calls up several parameters: Pattern Number, Beats, Signature, and the R-8's calling card, Feel. You'll enter most of your parameter data from a touch telephone-like keypad that has a sure, tactile feel and is centrally located.

The R-8 is really a pleasure to navigate once you get the hang of it.

One really nice touch is that the machine remembers where you were when you last worked in the previous mode. Three edit buttons (Sound, Performance, and Feel) also call up submenus in the display. Sound refers to parameters in your five basic kits, as distinguished from Performance, which attaches edited parameters to songs and patterns. Feel accesses the humanizing features. A value slider works as the coarse adjuster for the edit parameters, while the +1 On and -1 Off buttons allow for fine tuning.

You'll maneuver through your menu displays with a set of cursors similar to those appearing on most recent synths and drum machines. A Page button escorts you deeper into features-land for many "hidden" functions. Overall, the R-8 is really a pleasure to navigate once you get the hang of it.

COME ON UP TO MY PAD

You'll be beating on sixteen touch- and pressure-sensitive drum pads, which have a harder feel than most other machines. Pressure-sensitivity may seem like an odd inclusion, but if you program a roll, pressure lets you change the level in a very expressive way. The low profile of the buttons keeps them from triggering and causing double hits, and you're advised to play lightly and tap them slightly under center. Even though using the R-8's pads is kind of like playing on astroturf, they work great and are designed for the long haul.

Most of the drum pads also serve double or triple duty when pressed in conjunction with the Shift/Erase button. Pad level assignments venture into the exotic vein, with eight curved, level scales provided to serve just about every conceivable situation. Eight separate audio outs are provided in the rear of the machine for instrument outputs.

WHY DO THEY CALL IT HUMAN?

Possibly influenced by the "Feel Factor" article (October 1987 EM) as well as Intelligent Music's unique *Upbeat* software, which algorithmically randomizes drum machines according to user-defined guidelines, Roland felt they could extend the frontier of drum machines by incorporating these "human" features, called "Feel," into the R-8. They succeeded.

The simplest humanizing feature to understand is Nuance. This program-

mable variable electronically simulates different ways of hitting a drum or cymbal. With cymbals, for example, Nuance determines whether the cymbal is played nearer its center or its outer edge. Better yet, you can program randomization into your strikes, letting the genie inside the R-8 replicate the natural "nuances" of a human drummer. You can also add more or less Nuance to certain drums by hitting them louder or softer. Nuance's effect is most immediately felt when applied to the hi-hat: instead of monotonous, robotic regularity, Feel re-creates the realism of a live drummer jazzing things up, hitting the cymbal with different amounts of force and in different positions. If you want a mechanical beat, set Nuance to zero. Nuance can be applied to most of the 120 instruments.

Feel Patches, which you can specify for each pattern, are eight user-writable combinations of Groove and Random Factors. Groove basically creates accent and tone changes. Random Factors set the amount of freedom you'll give edit parameters to roam from their assigned values. To illustrate how deep this area goes, you can let Groove and/or Random Factors affect every one of your edit parameters (Velocity, Pitch, Decay, Nuance). What's more, Groove or Random Factors can be set for each separate instrument or step of a pattern. A Groove Switch turns every instrument on or off in the Feel Patch. The Random Depth and Random Probability of your Random Factors are also adjustable. To sum up, all the different settings of Groove and Random Factors you come up with are stored as a Feel Patch, which is shown, along with pattern numbers, in the menu display. You can even audition different Feel Patches with different pattern numbers.

One important point is that the Feel changes are subtle. Play someone a pattern that makes great use of the feel parameters, and odds are the first reaction will be "so what?" That's because the feel changes make drums *sound like they're supposed to.* Take away the feel changes, though, and you'll immediately notice that you're back in robotland. Plumbing the depths of Feel Patch will earn you a well-deserved coffee break along with some great-sounding patterns, but it's not necessary to use a Feel Patch with your patterns (none of the factory patterns do). Before the Human Rhythm Composer, there hadn't been a major breakthrough since touch-sensitive pads. But Feel Patch is indeed a breakthrough and is an impressive contribution to drum machine realism.

OTHER INNOVATIONS

The User's Functions feature is my favorite: a bank of ten user-defined, macro combinations of up to sixteen operations, each of which you can call up by merely assigning your string of commands to User's Functions 0 to 9. Not only is Roland letting its machine run random, it's giving you the opportunity to custom-automate its software. This feature actually works, though I initially found this kind of power emotionally unsettling. You can erase or reassign User's Functions at any time, or copy them to other User's Functions positions. At the touch of one button, this eliminates wading through all the layers of pages to get at an obscure section of the machine only you are weird enough to use. This is earth-shattering stuff.

Macro mode (not to be confused with the macro combinations in the User's Functions) repeats a selected "macro note" (drum), at the intervals and volumes you select, over the course of a measure (which can run sixteen steps). Once the macro is in memory, you can play it back by hitting a single keypad. This is useful for creating delay effects or making several drums duplicate each other. You can set up to ten macro notes and cancel them as desired. Ample instructions are given for inserting macro notes in pattern- or step-writing.

In Multi-Assign, you can assign one instrument to all sixteen pads and edit (or, in some cases, ravage) the sound to your heart's content. The Instrument Align submenu entry takes, say, an agogo and serves up sixteen different agogos with scaled pitches, decays, and nuances. You can also assign one instrument to follow notes on your MIDI keyboard. Days later, when you get bored with this, hit the Multi button again, and you're back to one of your Pad Banks, ready for your next electronic caprice.

Reframe is a much-needed utility. How many times have you dazzled yourself writing a killer pattern, only to discover that it didn't start on the downbeat? You'll no longer be penalized for this common *faux pas*, because the R-8 will gladly "reframe" your pattern with just a few entries and cursor movements. Partial Pattern Copy lets you copy as

● ROLAND R-8

many beats/measures from a pattern as you desire. Merge Mode lets you merge two separate sequences of the same length; this is particularly useful if you set up a melodic line using all sixteen keypads in Multi assignment, then want to combine it with a backbone boom-whack.

RECORDING MODES

Real-time pattern recording is straightforward. You can attach performance parameters to every pattern (a very helpful feature). If you're ambitious, you can assign different parameters to every step in step entry. The R-8 includes three different methods of step entry: Basic, Normal, and Scope. Basic is what you'd expect. "Normal" step edit actually seems pretty exotic to me. One instrument, let's say the snare, can be assigned to all drum pads (1 to 16) using the Multi button while in Instrument Assign. Each pad now plays the same sound, or variations of the same sound if you selected the aforementioned Instrument Align.

Let's say your pattern has sixteen steps. Pad 3, for example, corresponds to box 3 in the sixteen-step grid of the LCD. Press Start. Now if you hit pads 3 and 8, that places the snare in steps 3 and 8 of the pattern, and circles appear in boxes 3 and 8 of the LCD grid. You hear the snare in beats 3 and 8. Hit Stop. Now the next drum pad you hit becomes spread out over the sixteen pads, ready for its "Normal" step entry. To go one step further, you can specify two other instruments, 2 and 4, to be displayed in the grid. Scope editing allows you to magnify entries in your step measure up to 1/96th note. *Whew.*

The methodology of Song construction is ridiculously extensive. You'll make a list of patterns like in any other drum machine, but here come those features again. You can start from any part of your song, insert a tempo or volume change at any point, or set up any section of your song to repeat, saving you hundreds of pattern entries. You can even repeat sections within sections ("nesting") up to eight times. Then you can label your song parts and search between them, much like negotiating between the markers in a computer sequencing program. You can see your labels in the write mode but not the play mode, which brings me to my criticism of Pattern and Song.

In Song, you'll be switching between submenu entry Write, to construct your

The methodology of Song construction is ridiculously extensive.

song, and submenu entry Play to hear your song. You'll have to hit Exit to call up the submenu, and keypad number 1 or 2 to alternate these procedures. Pressing Start in Song Write only repeats the pattern that is displayed. This seems unnecessarily tedious, especially considering the ease with which you fly around the other functions on the machine. Likewise, if you're in Pattern Step Write, hitting Start will not play the pattern; once again, you'll have to access the Play submenu.

Fortunately, User's Functions help circumvent this roadblock. For instance, you could use User's Functions to audition how patterns sound going into and coming out of each other by assigning each combination a User's Function. Here's another idea: to get at Song Labeling you'd have to hit Select five times before the display finally gets to Song Label. Just set up a User's Function that memorizes this combination, press a button, and you're ready to label.

In Song mode, the cursors step exponentially through each pattern number by holding them down and scrolling; you don't have to keep tap-tap-tapping the cursor buttons. The +1/-1 buttons will similarly whiz through a rhythm pattern's steps. Pattern or Song names are displayed when the machine is stopped. In Pattern mode, the readout switches to numbers so you can select another pattern to play after the one currently displayed. Songs and Patterns can easily be named with up to eight letters or numbers, entered from the keypad. You can construct up to ten songs and chain them together any way you like. This doesn't sound like a lot of songs, but with all those humanizing functions, the machine's RAM has enough to do.

VISIBILITY

One regressive area of the R-8 is that the display is a continuation of the LCD Roland has used on its TR-626 machine and predecessors. One of those predecessors, the TR-707, displayed the step

assignments of nine fixed instruments, which is an example of why I feel the R-8's display is regressive.

The lower-left quarter of the LCD gives you a readout the size of the basic Yamaha RX5 or Kawai R-100 readout. On top of that is a section of equal size with information about Modes, Pad Banks, and the like. Unfortunately, these entries stand 1/16th of an inch high.

The other half of the LCD is a grid showing the four assignable parts of your step entry, panning, or velocity assignments. There is a lot of wasted space above the grid that might have been used for making the other entries larger or to provide space for more instruments to be displayed in the grid. While a lot of information is presented, it's a shame it's so difficult to see: the LCD is almost impossible to read unless you are hovering above it. Worse, the way the display is lit, without the yellow or amber backlighting you've come to expect in LCDs, you absolutely cannot see what you're doing in anything less then direct light. Although the brightness is adjustable, nothing helps in a mood lighting situation.

There is a trend toward using drum machines as sound modules. You decide if this is the best way to make use of the R-8's sound editing.

MIDI

We switch from regressive to wildly progressive: the MIDI implementation is pace-setting. Let's start with the ability to receive on five MIDI channels. One is for the instrument section, while up to four other channels can be designated to receive performance parameters. You could amuse yourself by using one of your MIDI performance channels to set a selected percussion instrument to echo the melody of a synthesizer. You can designate your master keyboard to change parameters on the R-8 by hitting notes above or below middle C. There are four choices of bulk dumps depending on what you want to jettison. Unlike many other popular units, you can spread your note assignments over an entire keyboard. As far as I can tell, you could assign all 120 instruments to one note, if you were deranged enough. How about program changes received in both Pattern and Song modes? Yes. Suffice it to say that if a MIDI job can be done, the R-8 can do it.

There has been a trend, in the MIDI world, toward using drum machines as sound modules played from a master keyboard. You're going to have to decide if this is the best way to take advantage of the R-8's onboard sound editing as opposed to using MIDI controllers and, say, a modulation wheel to enter changes into a dedicated or computer sequencer. In other words, humanizing functions such as Feel Patch and Nuance are going to be easier to edit on the R-8 itself. One option is to return the R-8 to the former glory of drum machine as master clock and let it drive your sequencer. Perhaps the best solution would be to build all your instrument (drum and cymbal) information on your sequencer, then send it back out to the R-8 where you can edit it as song data with performance parameters. What seems like a dilemma is actually unlimited flexibility; you can see what works best for your specific application.

AND THE VERDICT IS...

Those who have done away with drum machines in favor of samplers and multitimbral synths will need to readdress the issue. There are numerous arguments pro and con. Many MIDI maniacs are happy using Roland's multitimbral D-110 synthesizer as their drum machine; if they had a computer and added Upbeat, you might think they'd have the same power as the R-8, right? Maybe. Aside from the D-110's lack of a Nuance function, Upbeat has a steeper learning curve than the R-8, and you have to dedicate a computer to running the program. The R-8 costs the same as the 12-bit D-110, but the D-110 has the additional attraction of many worthwhile synth sounds.

Comparisons are difficult to make, because the R-8 is costlier than many other drum machines, and besides, older drum machines are often available second-hand at prices so attractive that one is willing to overlook a missing feature or two. Also, sound quality is highly subjective: you may hate gated snares, and I may like them. Your only real option is to look at your budget, listen to the sounds, and decide for yourself. To my ears, the only non-sampling machine with equivalent sound quality is the Alesis HR-16, which is half the price but also has fewer than half the sounds, a less sturdy housing, fewer features, and cannot change its sounds.

Simply stated, Roland has pulled out all the stops. If you're looking for a great drum machine and can spend nearly $1,000, as far as I'm concerned, the Human Rhythm Composer is the new heavyweight champ.

(Thanks to Robb's Music in Boulder, Colorado, for the use of the test machine.)

Lory Kohn *demonstrates Macs 'n MIDI for Apple's Denver Regional Office. He is the president of Dairyland Products, whose silo of hits includes his CDs* Music For Art Openings *and* Fairyland: Music For Babies. *He notes it takes a real man to write a song called "Fairyland."*

Product Summary

PRODUCT:
Roland R-8 Human Rhythm Composer

TYPE:
Drum machine and/or sound module

RETAIL PRICE:
$995; $140 for additional RAM cards, $74.95 for ROM cards

FEATURES:
120 16-bit, PCM sounds; multiple MIDI receive channels; user-definable macro commands; eight separate outputs; 230-page manual; exceptional flexibility

MANUFACTURER:
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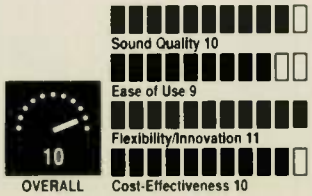
7200 Dominion Circle
Los Angeles, CA 90040-3647
tel. (213) 685-5141



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GO WITH YOUR FEELINGS, LUKE

Is quantization solving a problem or is it the problem? Maybe it's a habit left over from the days of sloppy hardware, not necessarily a cure for sloppy playing.

By Craig Anderton

There's a scene in the first *Stars Wars* movie where Luke, the hero, is training to become a Jedi knight. Frustrated in his attempts to head off mock attacks by a small attack droid, he's advised to go with his feelings and, by using his intuition, succeeds.

Musicians also count on feelings, especially since the qualitative value of music can't be quantified (if it could, record companies would know what makes a hit). Yet, due to the difficulties of making a living in their chosen profession, musicians are frequently an insecure bunch. As a result, musicians who should be trusting their instincts instead spend a lot of time questioning them.

One more story: a group of students was asked to perform a series of calculations, first using a calculator and then using paper and pencil. What they didn't know was that the calculators had been modified to make mistakes, but by and large, the students gave the answers arrived at by the calculator rather than trust their own answers.

So what does this have to do with quantization? My first experience with sequencers was with a low-resolution model, and whenever I played anything without quantizing, my timing sounded dreadful. So naturally, I quantized. Sure, much of the "feel" was lost in the process, but at least it was right on the beat.

Then I started doing a lot of electronic work with Spencer Brewer, who's primarily an acoustic piano player. As a solo artist, he's never really had to follow a drummer and, therefore, tends to play around the beat rather than dead on it. Funny, when we sequenced his playing, his timing sounded weird too.

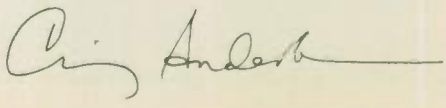
I also noticed that when I recorded parts on tape, all of a sudden my rhythmic sense improved dramatically. Hmm. I assumed this had something to do with my attitude, or perhaps the phase of the moon. After all, when I quantized the sequenced parts, it was obvious how "off" my playing really was.

Eventually, I graduated to a shiny new sequencer with 240 pulses per quarter note resolution, but I kept quantizing, out of habit, to correct my "mistakes." Then, one day, I was recording with Spencer again. He was playing to a click track and had recorded what sounded like a rhythmically perfect take. On playback, it still sounded perfect. But when I went to clean up some note velocities and such, I was amazed to discover that very few notes fell on anything even close to the beat. Investigating further, I noticed all the timing was *internally* consistent. For example, for certain groups of measures, he'd rush the downbeat slightly, then during the course of the measure, slow down a bit to catch up, only to again rush the downbeat of the next measure. Then I looked at a MIDI guitar solo I had played against his track that also sounded rhythmically flawless, but some notes were as much as 30 milliseconds off the beat.

This is when I realized that these subtle timing variations got mutated into something far grosser on sequencers with low resolution, and that's why the parts sounded wrong. So I started experimenting. I tried recording a repetitive, eighth-note hi-hat part against a bunch of unquantized parts that sounded excellent together. The hi-hat part fell right in the pocket, but when quantized, it sounded wrong.

As Michael Stewart pointed out in "The Feel Factor: Music with Soul" (October '87 EM), changing a few milliseconds here and there really can improve the feel of quantized parts. But the more music I analyze, the more I find large timing variations, and the more I'm convinced that small and large variations are what makes music sound alive. Nowadays, rather than try to compensate for deficiencies in quantized parts, I tend to leave quantization off altogether. If, on playback, I hear a note that's obviously off—to my ears, not according to the numeric readout of its start point—I'll fix it. Even then, though, I usually don't just quantize it; remembering the "Feel Factor" guidelines, I examine neighboring notes to see if they're leading or lagging the beat, and I adjust the start point accordingly. I'm even beginning to question the value of quantization for bass and drum parts, since if you quantize those, then all the subsequent overdubs lock right into that flawed feel and have a hard time "breathing" with the part.

If your chops are even close to good enough, and your sequencer has high enough resolution, think of quantization as something you do during mixdown to fix the occasional bad note on an otherwise well-recorded track rather than something you automatically do as soon as a track's recorded. *You* have a better idea of what makes good-sounding music than a computer's quantization algorithm—so go with your feelings, Luke.



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