Digital Tape Primer ◆ First Look: Yamaha VL1 Synth!

Electronic Musician

June 1994

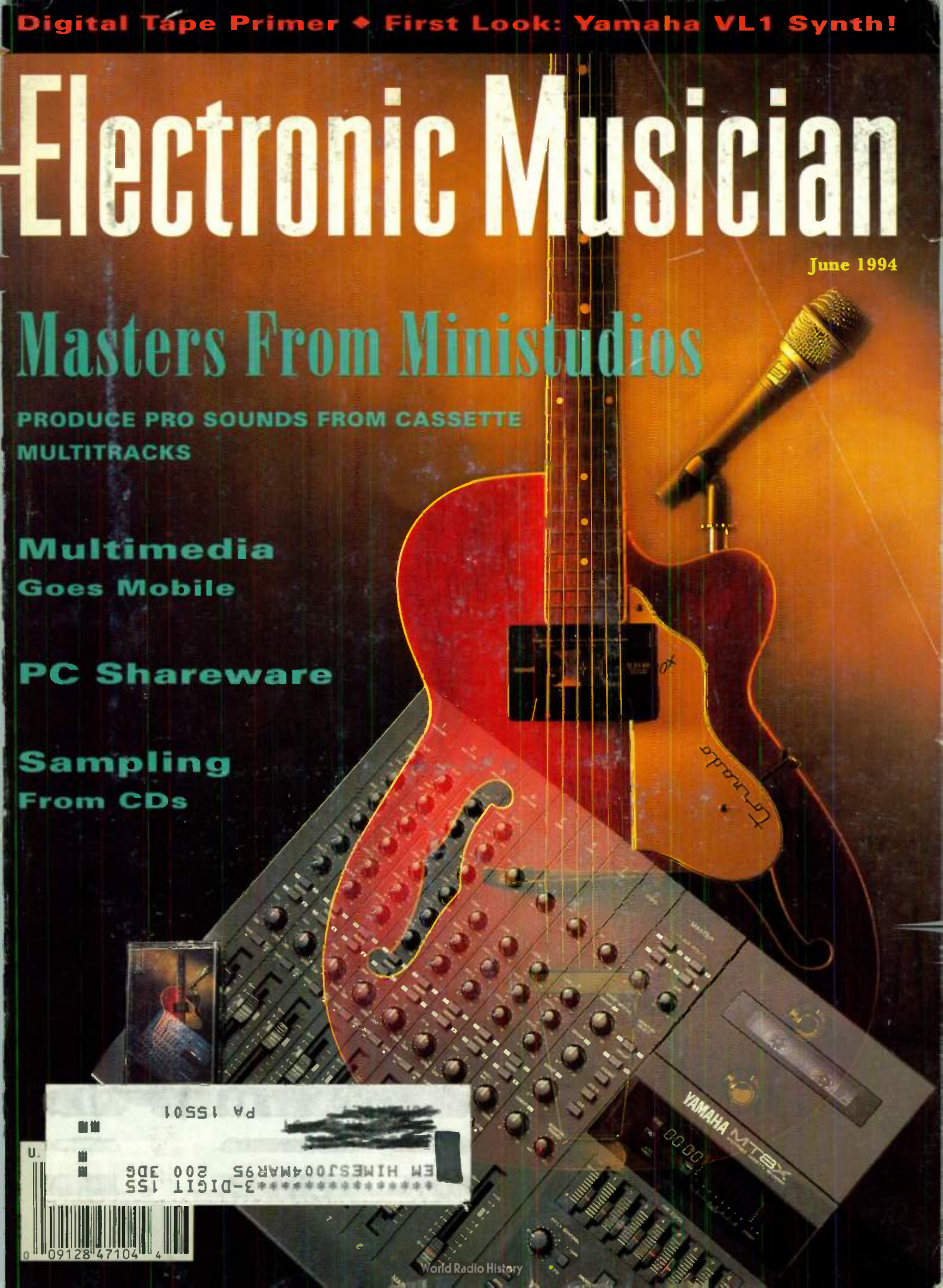
Masters From Ministudios

PRODUCE PRO SOUNDS FROM CASSETTE MULTITRACKS

Multimedia
Goes Mobile

PC Shareware

Sampling
From CDs

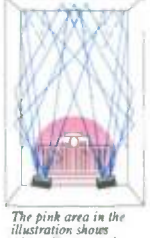


The Truth From Left To Right

The truth...you can't expect to find it everywhere you look, or *listen*. But when mixing music, hearing the truth from your monitors will make the difference between success and failure. You'll get the truth from the **Alesis Monitor One™ Studio Reference Monitor**.

Room For Improvement

Fact: most real-world mixing rooms have severe acoustical defects, with parallel walls, floors and ceilings that reflect sound in every direction. These reflections can mislead you, making it impossible to create a mix that translates to other playback systems. But in the near field, reverberant sound waves have little impact, as shown in the illustration. The Monitor One takes advantage of this fact and is built from the ground up specifically for near field reference monitoring.



The pink area in the illustration shows where direct sound energy overpowers reflected waves in a typical mixing room. The Monitor One helps eliminate such complex acoustic problems by focusing direct sound energy toward the mixing position.

The Truth From Top To Bottom

The Monitor One's proprietary soft-dome pure silk tweeter design delivers natural, incredibly accurate frequency response while avoiding high frequency stridency and listener fatigue–typical of metal-dome tweeter designs. The Monitor One overcomes wimpy, inaccurate bass response–the sad truth about most small speakers–with our exclusive SuperPort™ speaker venting technology. The design formula of the SuperPort eliminates the choking effect of small diameter ports, typical in other speakers, enabling the Monitor One to deliver incomparable low frequency transient response in spite of its size.

Alesis SuperPort™ technology gives you the one thing that other small monitors can't: incredibly accurate bass transient response. No, the SuperPort doesn't have a blue light, but it makes the picture look cool.

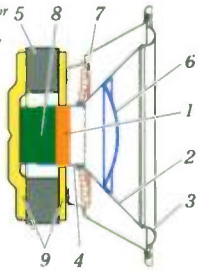
The result? A fully integrated speaker *system* that has no competition in its class. You'll get mixes that sound punchier and translate better no matter what speakers are used for playback. The Monitor One's top-to-bottom design philosophy is a true breakthrough for the serious recording engineer.

Power To The People

While most near field monitors average around 60 watt capability, the Monitor One handles 120 watts of continuous program and 200 watt peaks...over twice the power. The Monitor One provides higher output, more power handling capability, and sounds cleaner at high sound pressure levels. If you like to mix loud, you can.

The Engine

Our proprietary 6.5" low frequency driver has a special mineral-filled polypropylene cone for stability and a 1.5" voice coil wound on a high-temperature Kapton former, ensuring your woofer's longevity. Our highly durable 1" diameter high frequency driver is ferrofluid cooled. Combined, these two specially formulated drivers deliver an unhyped frequency response from 45 Hz to 18 kHz, ±3 dB. The five-way binding posts provide solid connection, both electronic and mechanical. We even coated the Monitor One with a rubber textured laminate so when your studio starts rockin', the speakers stay put. Plus, it's fun to touch.



A cross section of the Monitor One's proprietary Alesis-designed 6.5" low frequency driver.

1. 1.5" voice coil.
2. Mineral-filled polypropylene cone.
3. Damped linear rubber surround.
4. Kapton former.
5. Ceramic magnet.
6. Dust cap.
7. Spider.
8. Pole piece.
9. Front and back plates.

The New Alesis Monitor One™

You don't design good speakers by trying hard. It takes years and years of experience and special talents that only a few possess. Our acoustic engineers are the best in the business. With over forty years of combined experience, they've been responsible for some of the biggest breakthroughs in loudspeaker and system design. The Monitor One could be their crowning achievement. They're the only speakers we recommend to sit on top of the Alesis Dream Studio™.

See your Authorized Alesis Dealer and pick up a pair of Monitor Ones. Left to right, top to bottom, they're the only speakers you want in *your* field.

For more information about the Monitor Ones and the Alesis Monitoring System, see your Authorized Alesis Dealer or call 1-800-5-ALESIS.

Alesis Corporation 3630 Holdrege Avenue Los Angeles CA 90016

ALESIS
STUDIO ELECTRONICS

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NEW PRODUCTS!

NEW! SESSION 8™ MAC

Digidesign's award-winning integrated personal digital studio is now available on the Macintosh® Featuring 8-channel digital recording, random-access editing, digital mixing & bouncing, and MIDI sequencer integration. Digidesign Session 8—the personal digital recording studio with full-featured professional studio quality.

NEW! DIGIDESIGN® ADAT INTERFACE™

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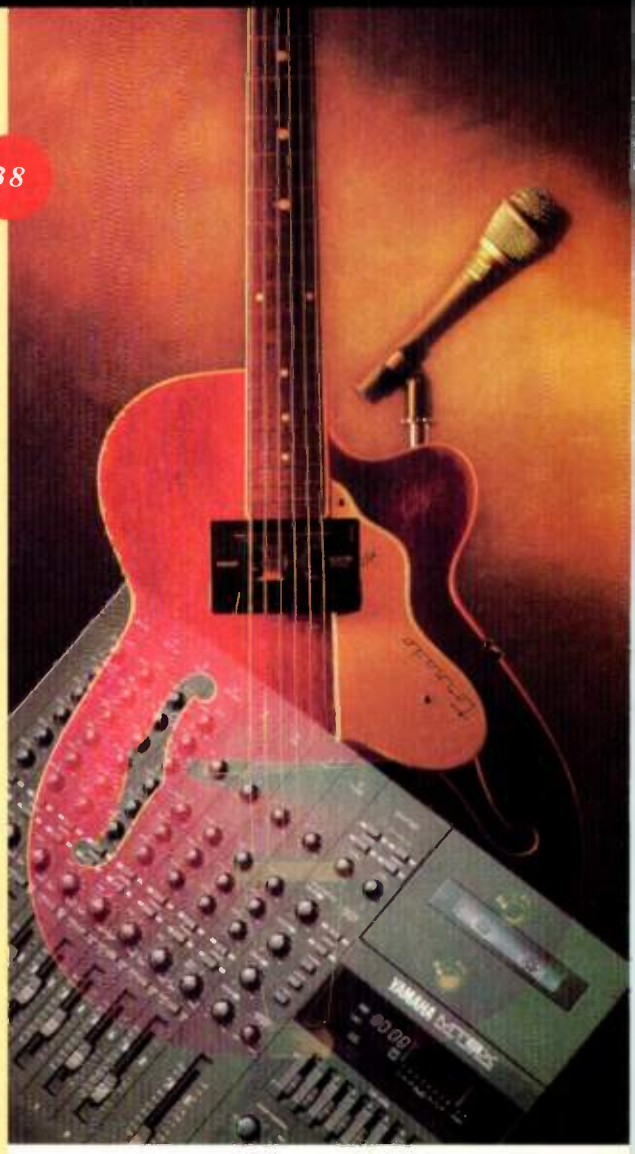
I N S I

FEATURES



DEPARTMENTS

D E Electronic Musician
JUNE 1994 VOL. 10, NO. 6

COLUMNS

REVIEWS

Cover: Photo by Robert Perry.

Special thanks to Yamaha. Vox guitar courtesy of Pacific Loan.

Beating The Odds

Electronic musicians know how to stomp all over creative limitations.

PEGGY SUE AMISON

Classic Greek tragedies portend that mere mortals cannot escape the tendrils of fate. What kind of defeatist hooey is that? I respect the works of Aristotle and Aeschylus and the facile dramatics of "As it is written, it shall be," but I find no poetry in a sure thing; no sex appeal in absolute power. For me, true exhilaration is in the ascendancy of the underdog, from David and Goliath to the exploding-from-nowhere skiing of U.S. Winter Olympic gold medalist Tommy Moe.

I also love to hear about hit records and film soundtracks that were recorded outside of the professional arena. Don't tell me a piece of equipment delivers "semiprofessional" audio quality, or home studios are only capable of producing demos. Who is spreading this stuff? I am constantly energized by evocative and absolutely slamming tracks produced by "nonpros" on all kinds of recorders. If you find this hard to believe, just open your ears.

A substantial percentage of rap and dance-music hits are conceptualized, tracked, and mixed in personal studios. In the July 1993 issue of **EM**, we detailed how the soundtrack for the Columbia Pictures release *El Mariachi* was produced by two college students—Eric Guthrie and Chris Knudson—in an apartment MIDI studio. And one of the proudest achievements in my twenty-odd years in the music biz is that the recording studio I co-own has produced international major-label releases, audio for film and video, national radio jingles, and television underscores with a "semipro" Tascam MS16 1-inch, 16-track recorder. (The professional standard is 2-inch, 24-track.) If musicians have the desire to create great work, it can be done.

Overcoming limitations is a tradition at **EM**. Our do-it-yourself projects didn't start out as diversions for hobbyists. Back in the magazine's infancy, these DIYs were creative life lines to electronic musicians who couldn't afford factory-produced tools. And sometimes, these tools weren't even *available* commercially. Today, prices for amazing recording technology have fallen to almost socialist levels of affordability. But even so, not every **EM** reader can cough up the bucks for an ADAT, DA-88, or hard-disk recorder. Do we just give up, allowing fate's tendrils to wrap around us until inspiration is suffocated? No! Along with our features on hot new products (which we gearheads drool over, whether we can afford them or not), we publish articles that tell you how to get the most from what you've got. I believe mental limitations stifle creativity far more viciously than equipment limitations. We'll give you the tips, tricks, and technical information to make great recordings from just about any medium.

To this end, our cover story "Masters From Ministudios" (p. 38) is another self-help guide on how to beat the odds. Cassette multitracks are often characterized as playthings for amateurs or musical sketchpads. I've heard some engineers scoff at them, claiming they produce more tape hiss than music. Well, it's time to embarrass the naysayers. Read the article, record your masterpiece, and never ever say die. After all, David didn't have the option of trading his slingshot for a rocket launcher.

Michael Molenda

Electronic Musician

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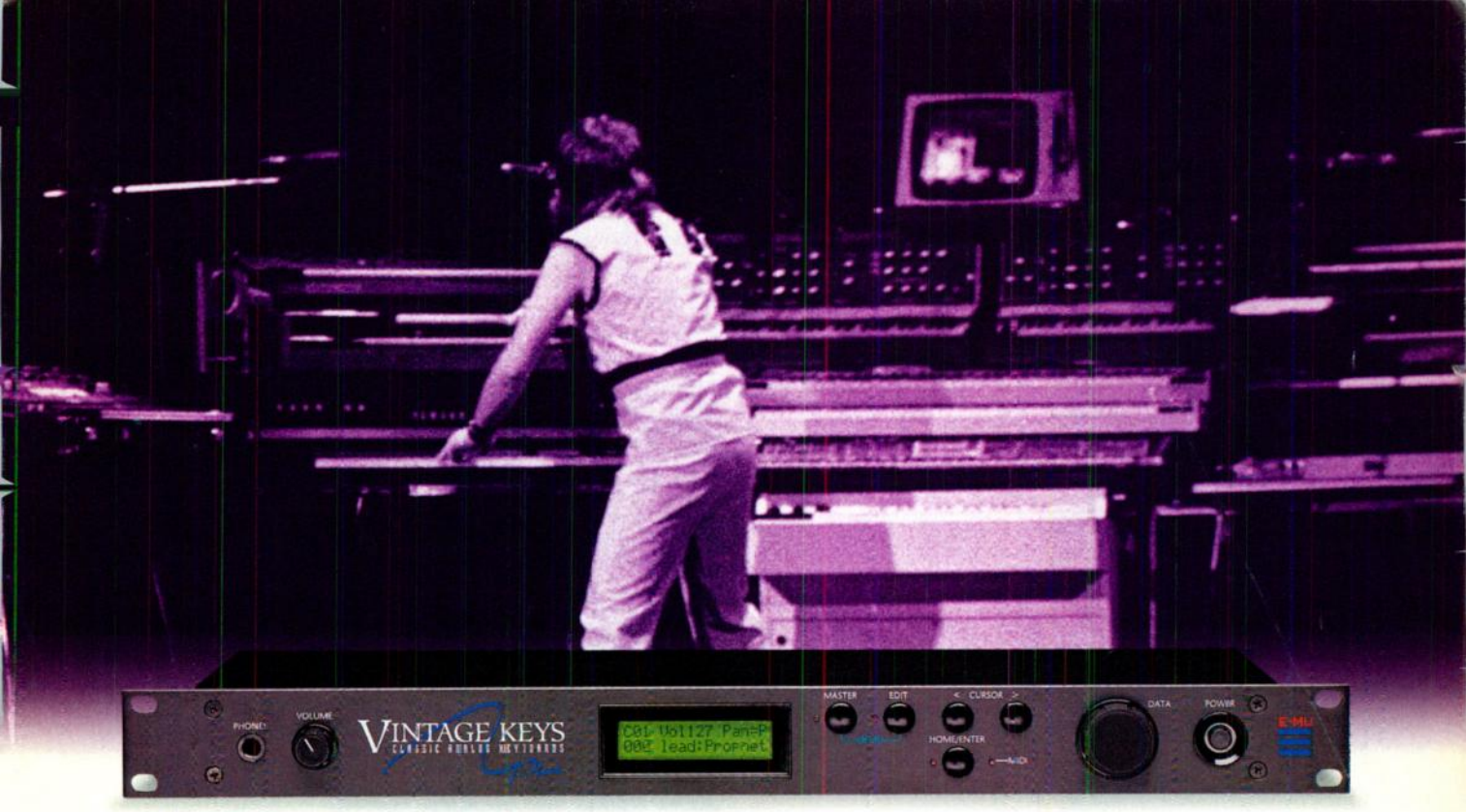

Vintage Keys Plus.

Jam-packed with even more analog keyboards.

The "Plus"—Great New Sounds Added. If you're feeling upstaged because you don't have as many classic analog keyboards as you'd like, relax. Now you can get your hands on more of those warm, rich keyboard sounds in the newest edition of Vintage Keys: Vintage Keys Plus. It has all the classic analog keyboards found in Vintage Keys, plus it offers more of the cool sounds you Vintage enthusiasts have been asking for, ranging from Dyno Rhodes and Yamaha FM synthesized electric pianos; to classic Emulator II and Emulator III sample snippets; to Sequential Circuits, Moog, Oberheim, Roland and ARP analog synthesizers; to E-mu® SP-1200, Roland DR-55 and Roland TR-808 drum machines; to classic stringed instruments like Chapman Stick, Fender P-Bass and Electric Sitar, to name just a few. That's an additional 8MB of high-quality, digitally sampled analog keyboard sounds in all!

Expanding Your Original Vintage Keys Is Easy. For current Vintage Keys owners who just can't get enough of that analog mood and feel, E-mu has good news: there's room in your Vintage Keys for the same additional 8MB of great keyboard sounds found in the "Plus." Just grab your Vintage Keys Expander kit and go for it! Installation is easy and so is the price.

Don't Forget the Original. But let's not forget the module that started it all—the original Vintage Keys. If you're dying for the classic fat basses, thick pads and sizzling leads of classic analog keyboards, but living within a tight budget, get down to your E-mu dealer and find out what the industry has been raving about for the past year. Vintage Keys' solid 8MB base of organs, electric pianos, analog synths and dozens more keyboard sounds is proof that the Vintage standard is alive and well.

Whether you choose Vintage Keys or Vintage Keys Plus, you'll get a fantastic collection of keyboard sounds that are yours for the playing. And they come wrapped in a single space module that offers you 32-voice polyphony, 16-channel multi-timbral capability and 6 assignable polyphonic outputs.

So what are you waiting for? Listen to a demo of Vintage Keys or the new Vintage Keys Plus today. Because those warm, rich keyboard sounds really are as sweet as you remember. And now there are more of them than you could ever imagine.

VINTAGE KEYS CLASSIC ANALOG KEYBOARDS Plus

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KURZWEIL'S PC88

The MIDI master keyboard with sounds to inspire

You want the brilliant ***Kurzweil*** sounds that musicians everywhere aspire to own; and you need a great-feeling master keyboard to drive your MIDI sound modules. Now you can have both, in one superbly-integrated instrument: the ***PC88 Performance Controller***.

The ***PC88*** has it all: the benefits of a 32-note polyphonic portable digital piano, expandable to 64 voices with an option board; quality sounds you won't find anywhere else; plus an extremely versatile MIDI master keyboard with fully-weighted 88-key piano action.

At home in the studio or on-stage.

KURZWEIL QUALITY SOUND

Check out the ***PC88***'s Performance section. Its 64 presets include Kurzweil's new, critically-acclaimed Grand Piano samples and other classic keyboard sounds – Fender Rhodes™ electric pianos, new Clavinet™ and harpsichord, rock and jazz organ, bass, acoustic guitar, vibes and marimba. And, of course, there's the renowned Kurzweil Orchestral String Ensemble. 64 superlative sounds a working musician really can't do without.

MIDI TO THE MAX

Our MIDI Controller section is designed for fast, intuitive access, with full MIDI functionality. The ***PC88*** can transmit on four MIDI channels simultaneously, is 16-part multi-timbral, and offers four completely independent zones which can overlap. Each zone has access to all controllers: pitch and mod wheels, four continuous pedal controllers, two footswitches, four front-panel sliders, three switches (momentary or toggle) and keyboard mono pressure. The controllers can generate both positive and negative values for easy crossfading. There's also an arpeggiator which can be synced to MIDI and can operate across any or all four zones, plus specified key ranges.

Specifications subject to change without notice.

PERFORMANCE CONTROLLER™

the working musician as well as the technician

CUSTOMIZED SETUPS & EFFECTS

In addition to 64 superb-sounding built-in factory presets, you can save 100 or more of your own fully-customized performance setups with any combination of voice and controller settings – single, split and layered programs and/or MIDI configurations. And you can layer or split any internal sound with other internal voices – and/or external MIDI instruments – up to four zones.

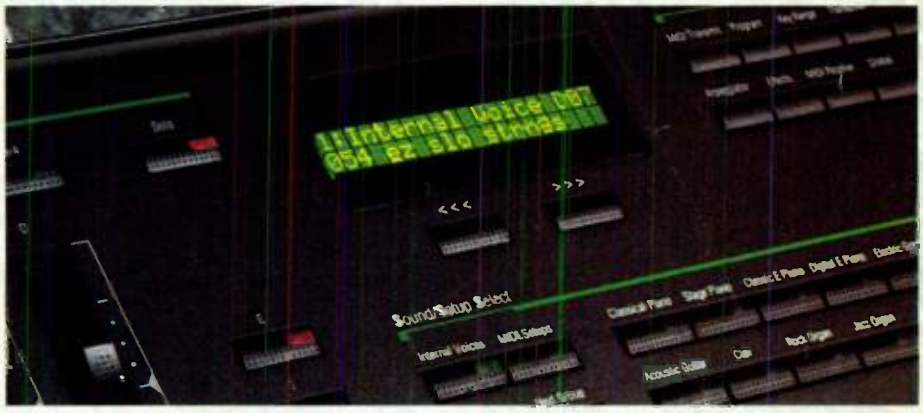
The ***PC88*** features a comprehensive on-board digital stereo effects processor, enabling you to program reverb, chorus and other effects, for a total of 48 different effect combinations.

The ***PC88*** weighs a mere 50 pounds, making it one of the lightest 88-key weighted keyboards you can own. A large backlit 40-character LCD display tells you exactly what's going on. The unit has stereo outputs and MIDI In, Out and Thru (switchable to a copy of MIDI Out).

PAINLESS EXPANSION

You can easily upgrade the ***PC88*** with an optional expansion card, offering over 200 more presets, as well as full General MIDI compatibility.

The expansion card also offers additional 32-note polyphony, giving you a full 64-voice instrument with over 265 sounds. There's a second independent stereo effects processor for the expansion section, so you can split or layer expansion sounds and presets, with independent effects on each.



Designed for the working musician, as well as the technician: the PC88 features an impressive array of MIDI functions with an intuitive, performer-friendly control interface.

Never before has a pro keyboard delivered so much in a single package: a great performance instrument and comprehensive master MIDI controller.

The ***PC88*** delivers what every keyboard player wants: great sounds, 88-key weighted piano action, full MIDI controller capability, on-board effects, optional expansion board with hundreds of sounds and General MIDI, plus portability.

Experience the ***PC88*** now, at your authorized Kurzweil dealer.

Let our inspiration be yours.

KURZWEIL

Music Systems

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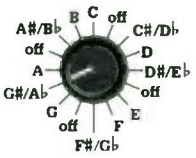
Pure Inspiration

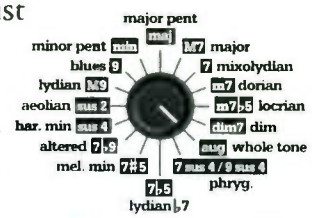
FRETLIGHT OWNERS ARE PLAYING BETTER BY THE MINUTE. AND YOU?

Chances are, you're not as good as you want to be. But if you were using a Fretlight™, you'd be a hot guitar player in no time.

That's because Optek™'s patented built-in electronic learning system lets you play smart. With the flip of a few switches, 132 inlaid LEDs light up chords, scales and note patterns on the fretboard, *in all 12 keys.* You master your music by keeping your eyes where they should be—on the neck of the guitar, not buried in some instructional book or chord chart.



The Fretlight isn't just another guitar. It's the ultimate reference tool. And it can be at your fingertips for just $699.00.



The Fretlight's three switches let you see thousands of chord and scale combinations.

Spend a few minutes finding out how to light up your guitar playing. For a free demo video and more information about selected dealers in your area, call us!

Why waste another minute?

Call 1-800-833-8306

FRETLIGHT™

by OPTEK™ MUSIC SYSTEMS

Optek Music Systems, 2005 O'Toole Avenue, San Jose, CA 95131

LETTERS

GOT 'IM

I'd like to thank **EM** for answering my questions about the severe RFI I was experiencing. I also want to thank B. Chandler Shaw for his additional information ("Letters," March 1994). It has all been helpful.

Fortunately, the problem with my neighbor's ham-radio broadcasting was resolved. In a transmission I overheard on my mixer, the neighbor foolishly admitted to using a linear amplifier, which is illegal. Writing a letter to the FCC accomplished nothing, so I wrote to my local congressman. He wrote to the FCC who, apparently now under pressure, wrote a warning letter to my neighbor, whose sky-high antenna had revealed the address of these transmissions. Now, the RFI problems have ceased, and I am a happy guy!

Ken Lee
Tujunga, CA

TIN-EAR ALLEY

In response to Shawn R. Curtis ("Letters," March 1994): I am a Korg wave-sequencing, TG33 vector-synthesizing, RA-50 Intelligent Arranger-using, *SuperJam!* algorithmic software-composing, retrofitted Casio horn-using, Roland AX-1-playing MIDI freak! I don't appreciate your bashing of us mediocre, or less-than-mediocre, players. I am greatly satisfied with "requiring the latest high-tech marvel" to arrange and perform my totally synthesized/sampled music.

Wake up and admit that now the band can go on without the keyboard player! You sound like the people who insist that students use T-squares and triangles, rather than learn CAD. It's the broadening of the consumer pool caused by today's instrument intelligence that has allowed *your* equipment to be affordable. So stop crying over the years you spent slaving through those lessons while guys like me were outside playing, because we are now in the studio making sweet music, too. And guess what? We are staying!

Well, I guess I'll take my tin-ear, step-entering self back to my studio, which just may produce more hits than you'll ever see.

Allen Tyrone Smith
Downingtown, PA

VIRTUAL VIRTUOSITY

I enjoyed "Virtual Mixing" by Scott Wilkinson (March 1994). Could you explain how vocals are integrated into the system when using computer mixing?

Jim Ryan
Detroit, MI

Jim—I'm glad you enjoyed the article. Vocals are integrated into computer-based mixers just like they are in any other sound system. One or more vocal microphones are connected to inputs on an external audio I/O (input/output) box. The signal from the mic passes through the computer (which takes the place of a traditional, physical mixer) and makes its way to one or more of the outputs according to the routing established by the user. The mic signal can be combined with other signals, if desired, and sent to a tape track, hard-disk recorder, or P.A. system.—Scott W.

UP FRONT

In the March issue's "Front Page," Mike Molenda boasted of the increase in female readership of your magazine. From the tone of the editorial, I assumed you felt this was a change for the better and hoped to increase this segment of the readership in the future. However, the editorial took on an ironic tone as I read through the rest of the magazine and spotted Roland Corporation's advertisement for the BOSS SE-70 (pp. 46-47), which contained a sexist catch blurb in the top left-hand page. It read, "Please, shelter the women, nail down the furniture, tie up the dogs, and just to make sure, fill out this card [pictured: DMV organ donor card] before pressing this button [line to power]," which implies that women aren't strong enough to deal with all the power coming from this machine. In addition, the sentence subtly compared women with chattel (furniture) and dogs, and it connotated that sheltering them is equivalent to nailing them down and tying them up.

This is a classic example of the type of sexism that pervades the electronic-music scene, and I can't help but wonder, if you wish to be a leader in combating such sexism, why you would print this ad. I realize a magazine relies on advertising for financial support, but if you claim to be at the forefront of the genre, you need to exercise some moral responsibility and hold the companies whose advertisements you display accountable for the content of those ads. Would you print an ad that contained a racial slur? Then why print something sexist? You are sending the message that it is acceptable to treat women as less intelligent and in need of constant guiding from their male counterparts.

I have also written to Roland Corporation asking them to consider a simple deletion that would make the advertisement acceptable to the other half of the population.

I am not only a part of the 9% minority of women who read your magazine, but I am also included in the statistics for part-time professional musicians and those who own personal studios. Please show me, and other hard-working female musicians, the respect we deserve when you decide what to print in your magazine. Actions speak louder than words.

Jenifer Felicity Joy
Beckett Skjeldahl
Eugene, OR

Publisher Peter Hirschfeld responds: *You raise several important issues that have empathetic ears at this magazine. We make a serious attempt to ensure the ads we print are responsible toward humanity and screen*

BRIAN RASZKA

out those that exhibit a lapse of perspective. On occasion, we have refused to run ads that other magazines have *run.*

However, there is a fine line between responsibility and censorship in the name of personal interpretation. The ad you cite is one in which interpretation is the critical aspect; Roland is an excellent, progressive company, and I can assure you they did not read the same connotations you perceive. This doesn't in any way make your reaction invalid, and I'm sure Roland will take your comments seriously. We will continue to ensure **EM** *treats everyone fairly while still allowing a certain aesthetic latitude among our advertisers.*

NOISE ANNOYS

Michael Molenda's article "The Acoustic Home Studio" (February 1994) was informative, but it failed to address a loathsome noise problem that has become ubiquitous in the last decade: the equipment in the studio.

When I built my first soundproof, electronic-music studio in the early 1980s, the loudest interior noise was a hum from the power supply of my Oberheim Xpander. Though I still have it, I never hear the hum anymore, because it is completely masked by the F Major drone of two computer fans and three hard-disk drives.

Like many home project studios, mine does not have separate control and isolation rooms, and it would be impractical not to be near the computers while working. This creates a severe noise problem when trying to record with microphones, further exacerbated by digital recording systems that cause the disks to grind constantly while recording. In desperation, I have wrapped the computers with pillows and blankets and stuck them behind desks, but the short length of the keyboard and mouse cables prevent moving them far enough away to be out of earshot.

An article suggesting ways to control this relatively new form of studio noise pollution would be most useful.

John Melcher
San Francisco, CA

ABBA NAUSEUM

After reading Greg Purkey's letter ("Letters," February 1994), I agreed with Michael Molenda: Mr. Purkey needs to lighten up.

But Mr. Purkey brings something else to mind. On their Zoo-TV tour, Bono of U2 said something about a well-written song being a wonderful thing, after which they broke into their most well-crafted song, "Angel of Harlem," which somehow segued into ABBA's "Dancing Queen."

The speed at which electronic noise-making is advancing should not blind us to the basics. Unless you're actually creating an electronic-sound composition, your song better stand up on its own. Otherwise, deep-six the thing and start over. After all, George Martin, Paul McCartney, and John Lennon all agree that "Strawberry Fields Forever" sounded best on John's solo acoustic demo.

Kenneth Killiany
Washington, DC

KICK-START

My eyes usually glaze over after a few minutes of reading a "gear" magazine, but they nearly popped out of my head over "Working Musician: Ten Ways To Kick-Start Inspiration" (December 1993). I have been writing songs for over twenty years and have used many of the methods suggested by Michael Molenda, but never would have been able to express them in such a clear, thoughtful, and inspirational manner. Surely articles like this are as important as the "specs" on the latest piece of equipment.

Deborah Holland
Los Angeles, CA

Keep up the excellent work. "Ten Ways to Kick-Start Inspiration" brought to mind a thought that I—and many others—have had for some time. Doesn't it border on superhuman that composers came up with their amazingly creative ideas before recorded music or sequencer-generated licks existed? I may be overreacting, but I think their talents should be declared the Eighth Wonder of the World. They didn't even have **EM** to turn to for ideas.

Tony Marshall
Gravity Belt Music
Memphis, TN

STRING STING

What is the best way to get a MIDI guitar to track and work better? I'm using a Casio PG-380. I have tried adjusting the string sensitivity from almost off to overload. I've been

using 0.46 through 0.09 strings. Would heavier strings help?

R. Wilson
(no address given)

Dear R.—Unfortunately, there is no way to completely avoid delays with most MIDI guitars. For one thing, the pitch-to-MIDI converter must determine the pitch you are playing, which takes at least two complete waveform cycles; the lower the pitch, the longer it takes the converter to determine what pitch you are playing. In addition, all MIDI sound modules exhibit an inherent delay of at least a few milliseconds. Older, unitimbral synths often have a shorter inherent delay, because they have less to keep track of than newer multitimbral models.

A MIDI-guitar guru I spoke to recommends using a standard 10-gauge set of strings, which roughly corresponds to the strings you're using (you might try a 0.10 string on high E). If you're sending MIDI in Mono mode on six different channels to a multitimbral synth, try turning off the unused channels. This lets the synth's processor concentrate on the important channels without constantly checking the unused channels for activity. If the Casio PG-380 has an internal sound module and you just want to send MIDI, turn off the internal sound module, if you can (turn off the Local parameter if it has one). This frees its processor to concentrate on sending MIDI.—Scott W.

ERROR LOG

April 1994, "OSC Deck 2.1 and Metro 2.41" sidebar, p. 49: We erroneously stated that OSC's *Deck II* is compatible with Digidesign's *DAE*. In fact, it is not *DAE*-compatible and does not support TDM plug-ins.

April 1994, "Teach Your Children," p. 73: We omitted some text in the fifth paragraph of the second column. The last sentence of that paragraph should read, "The operation and display screens must correspond to the documentation, which must also include system requirements, installation procedures, and instructions for use."

We welcome your feedback.

Address correspondence to "Letters," Electronic Musician, 6400 Hollis St. #12, Emeryville, CA 94608. Published letters may be edited for space and clarity.

It's like having a recording studio in your computer!

As a leading manufacturer of professional musical instruments, we weren't satisfied with building just another sound card. Instead, we built the RAP-10 Roland Audio Producer—a complete how-to solution for audio production on your PC.

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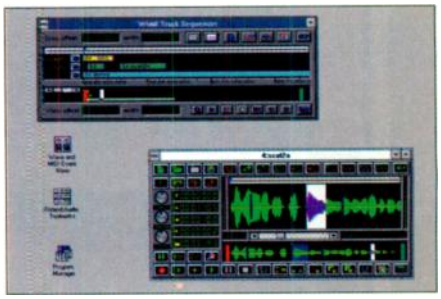
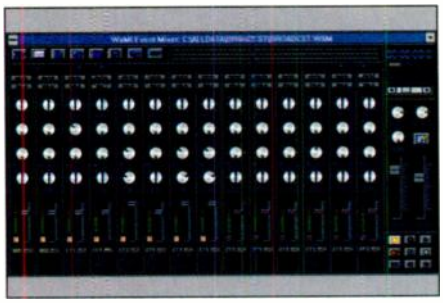
- Reverb and chorus processing
- Real-time audio mixing of all parts and channels
- Digital cut/paste waveform editing
- Compatibility with most sequencer software

Just bring in any standard MIDI file, add vocals or acoustic instrument parts, and then you control the mix. You can even re-orchestrate the music to fit your own personal style. And spot production for broadcast is fast and easy using the RAP-10's digital track merging and visual waveform editing.

Audio Toolworks provides an easy, visual way to remove sections of audio and cut out pops or clicks. Plus, it allows synchronized playback of your MIDI files and digitized recordings.





With this 18-channel audio mixing console, you simultaneously control up to 16 channels of MIDI with two tracks of digitized audio. What's more, all on-screen controls are fully recordable.

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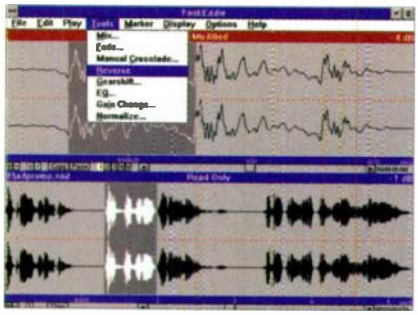
WHAT'S NEW

By Steve Oppenheimer



▲ DAL FASTEDDIE

Digital Audio Labs announced *FastEddie* ($199), a simplified WAV file editor. The program lets you do sample-accurate, nondestructive editing in one screen while viewing the original file in another.

Features include bass and treble EQ; cut, copy, and paste; custom fades, with linear or log curves; up to 300 markers per window, which can be set "on the fly"; waveform mixing; and zoom in/out. You can reverse a waveform, change playback speed by percentage, and normalize gain. The Edit History feature lets you retrace your last ten edits.

Included with *FastEddie* is *Playlist Editor,* which lets you play WAV files sequentially, or split a file into regions for remixing. Also included is *Sound Catalog,* a utility that lets you trigger WAV files by point-and-click, computer hot key, or MIDI from within any *Windows* sequencer. Digital Audio Labs; tel. (612) 473-7626; fax (612) 473-7915.

Circle #401 on Reader Service Card

▶ PEAVEY PCX 6

Peavey is offering the PCX 6 ($2,799) and PCX 688 ($3,299) sampling keyboard workstations. The PCX 6 has a 61-key, unweighted keyboard, while the PCX 688 features the same 88-key, weighted action found in Peavey's DPM C8 master keyboard. Both keyboards send Velocity and Channel Pressure and are housed in C8-style, hardwood cases.

The sampling features include 32-voice polyphony (sixteen stereo voices); 2 MB of dynamic sample RAM, expandable to 64 MB; 16-bit, 44.1 kHz recording; and full DPM SP sample-library compatibility. One MB of static sample RAM can be added. You can resample layered sounds and sequenced loops through the two onboard multi-effects processors. A 240 x 60 graphic display is provided for editing, looping, crossfading, etc.

The PCX instruments include 10 MB of ROM-based PCM waveforms, which can be combined with user samples in Programs, Performances, and drum kits. The user interface lets you organize instrument sounds, samples, and Performance setups in folders without copying and pasting, and macros help ease programming.

The 16-track sequencer can store up to 200,000 events. The audio inputs allow stereo recording to RAM, and the two digital audio tracks can be synched with the sequencer tracks. The audio tracks can be cut, copied, and pasted.

The PCX units have two SCSI connectors, a bay for an internal hard drive, a pitch wheel, two mod wheels, four programmable sliders, two footswitch jacks, and a CV pedal jack. Peavey Electronics; tel. (601) 483-5365; fax (601) 486-1278.

Circle #402 on Reader Service Card

▶ AWARD MATCHBOX DI

Award has introduced three specialized direct boxes. The Matchbox MB10 ($160) is designed for electric guitars and includes a treble control; defeatable, preset EQ; and preamp with defeatable G12T speaker simulator. The Matchbox MB12 ($160) emulates a classic tube bass amp and offers bass-guitar versions of the MB10's features, including a 15L speaker simulator.

The Matchbox MB11 ($160) for acoustic instruments has a Mega-Z input stage that provides impedance-matching. The unit's Pre-Shape feature emulates near-miking and filters the mids. The Hornsaver protects high-frequency P.A. horns by adding treble in the direct-injection box for more "bite," rather than adding treble at the source (which stimulates feedback and amplifies pick-rattle and other acoustic noises).

All three Matchboxes have unbalanced, ¼-inch inputs and simultaneously available, balanced, ¼-inch and XLR outputs.

A universal DC power system automatically senses and switches polarity and lets you use any AC/DC adapter that outputs 9 VDC to 30 VDC. The Matchbooks also operate on a 9V battery. S/N ratio is rated at 84 dBm (1 kHz @ 0 dBm output). Sound Enhancements, Inc. (distributor); tel. (800) 639-4668 or (708) 639-4646; fax (708) 639-4723.

Circle #403 on Reader Service Card

▼ GLYPH SCSI DEVICES

Glyph Technologies is shipping a line of SCSI-2 storage devices, available in rack-mount and nonrack, external enclosures. Designed for the digital recording and multimedia production markets, the units are compatible with PCs, Macs, and digital-audio recorders. Sampler compatibility includes Roland S-700/760/770, E-mu Emax and EII/EIII, Ensoniq EPS/ASR/TS series, Kurzweil K2000, Akai S1000/1100/2800/3000/3200, and Digidesign Sample Cell I/II.

The GCD-200R dual-speed CD-ROM drive uses a Chinon 535 mechanism with a Sony-style, front-loaded disk caddy. Access speed is rated at 220 ms and data transfer at 300 KB/sec. It is compatible with MPC Level 2, XA, Multisession Kodak PhotoCD, Mac HFS, High Sierra, ISO-9660, and CD-Audio. An internal auto-pickup lens-cleaning brush reduces dust.

One noteworthy feature is *Direct Sample*, a proprietary program that works exclusively with Glyph drives. It facilitates the transfer of digital audio directly from CD to a Mac (in AIFF or Sound Designer II format) or PC (in WAV format).

Rack-mount hard drives include 525 MB ($1,395), 1.2 GB ($1,795), 2.1 GB ($2,995), and 3 GB ($3,895). Glyph also offers several removable drives, including SyQuest 88/44 MB ($795) and 3.5-inch, 128 MB MO drive ($1,795). SyQuest 200 MB and 270 MB drives are expected soon.

All external drives cost $300 less than the rack-mount versions. Glyph Technologies; tel. (800) 335-0345 or (607) 275-0345; fax (607) 275-9464.

Circle #404 on Reader Service Card

▲ GRANDE NOTESCAN

Grande Software and Temporal Acuity Products have introduced *NoteScan* ($100 with TAP program upgrade) optical character-recognition (OCR) software for music notation. The program converts scanned 200 or 300 dpi TIFF files of a musical score into an intermediate file format for importing into TAP's *Nightingale* (Macintosh) or *Music Printer Plus* (MS-DOS) music-notation software. *NoteScan* is now included with both programs. Support for other notation programs is not currently provided but is planned for a future version.

NoteScan recognizes notes, chords, rests, accidentals, bar lines, stem direction, beams, flags, clef signs, key signatures, and ties. Either handheld or flatbed scanners can be used. Temporal Acuity Products; tel. (800) 426-2673 or (206) 462-1007; fax (206) 462-1057.

Circle #405 on Reader Service Card

▼ NOVATION BASSSTATION

Novation has announced the BassStation ($649.95), a MIDI-programmable, monophonic, analog bass synthesizer. The instrument has the same 2-octave (transposable over eight octaves), Velocity-sensitive, polyphonic keyboard as Novation's MM10-X MIDI controller, with spring-loaded pitch-bend wheel and assignable mod wheel. All parameters can be accessed with front-panel knobs and switches. The filter and envelope generators are completely MIDI controllable, and the unit has seven user-program locations that can be recalled via Program Changes.

Two audio VCOs are mixed and fed to a resonant VCF and a VCA, which can modulated by an LFO and dedicated filter and amplitude ADSR envelope generators. The audio oscillators can produce sawtooth or pulse (including square) waves. A front-panel knob, EG 2, or the LFO can modulate pulse width. The VCOs range from C-1 to C2, but oscillator 2's frequency can be increased by over three octaves, using the Range (octave), Semi-Tone, and Detune (±50 cents fine-tune) knobs. The filter-cutoff slope can be set at 12 or 24 dB/octave, and the cutoff frequency is continuously variable from 5 Hz to 10 kHz.

The EGs can be single-triggered (the envelope isn't retriggered if a second key is pressed), multiple-triggered (the envelope retriggers), or triggered with autoglide (when a second key is pressed, the pitch glides to the new note, and the envelope retriggers). A Portamento knob is also provided. Music Industries Corp. (distributor); tel. (516) 352-4110; fax (516) 352-0754.

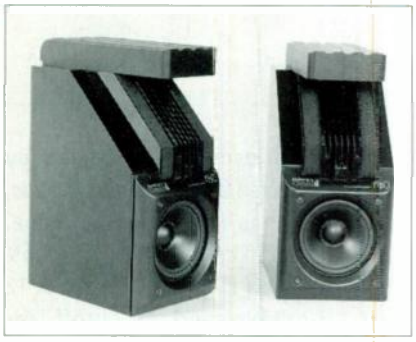
Circle #406 on Reader Service Card

▼ HAYES PASCUAN

Hayes Loudspeakers of Australia introduced Pascuan studio monitors ($899/pair), which utilize a unique technology to achieve an enhanced soundstage. The company's passive, Fractal Spatial System (FSS) uses a downward-facing tweeter design that radiates sound waves as fractals, so they reflect off all surfaces in a listening room, as a "live" sound source would. This expands the front-to-back depth of the stereo soundstage. According to the manufacturer, the 2-way system's diffusion pattern is truly hemispherical to well above 10 kHz.

The drivers include a 5-inch woofer and a 1-inch, soft-dome tweeter. The bass-loaded enclosure has a rear-tuned port. The Pascuans require 25 to 80 W_{RMS} per channel into 8 ohms. Sensitivity is 86 dB (@ 1W/1m). Frequency response is rated at 70 Hz to 20 kHz, and fractal diffusion bandwidth at 4 kHz to 20 kHz. The cabinet measures 6.5 × 14 × 12 inches and weighs thirteen pounds. Hayes Omni USA (distributor); tel. (408) 662-0421; fax (408) 662-8650.

Circle #407 on Reader Service Card



▶ ROLAND GR-09

Following on the heels of its GR-1 guitar synthesizer, Roland has presented the simplified GR-09 ($995). The GR-09 comes with 2 MB of samples (180 Tones), which can be doubled with a 4 MB expansion board (GR9E-1; $195). The user-installable expansion board adds ethnic instruments, guitars, electric pianos, and synth waveforms. The unit includes chorus and reverb.

The GR-09 uses Roland's new GK-2A Guitar Synthesizer Driver ($250), a smaller, but functionally identical version of the company's well-established GK-2 pickup. As with the GR-01, the link between the pickup and floor unit is faster than MIDI, so tracking delay is less problematic. Roland Corporation; tel. (213) 685-5141; fax (213) 722-0911.

Circle #408 on Reader Service Card

▶ ADA DELUXE PEDAL PACK

ADA has unveiled a new family of MIDI footswitches. The MPC MIDI Program Changer ($129.95) uses Bank Up and Down buttons and ten numbered buttons (0 to 9) to send MIDI Program Changes. An LED display shows the currently selected program. The MXC (MIDI eXpandable Controller; $199.95) looks identical to the MPC and offers the same Program Change functions, but it also has four programmable jacks for continuous controller pedals and switches.

The CCP Continuous Control Pedal ($79.95) for the MXC features a soft switch at the top of the pedal's travel that toggles the current function on and off. The MQS MIDI Quad Switch ($79.95) also works with the MXC, providing four additional toggle buttons, which can operate as momentary or latching switches. Individual LEDs indicate each button's status. The MXC, CCP, and MQS can be purchased separately, or as a Deluxe Pedal Pack ($299.95). All the new ADA footswitches use the company's phantom-power system. ADA Amplification Systems; tel. (510) 532-1152; fax (510) 532-1641.

Circle #409 on Reader Service Card

▶ CAIG PROGOLD

CAIG has introduced ProGold, an environmentally safe, aerosol cleaner, conditioner, and preservative for gold, base metals, and other precious-metal contacts and connectors. It is nonabrasive and noncorrosive, sealing and protecting gold surfaces and reducing wear, tarnishing, and abrasion. The solution inhibits arcing and RFI, improves conductivity, and reduces intermittent connections.

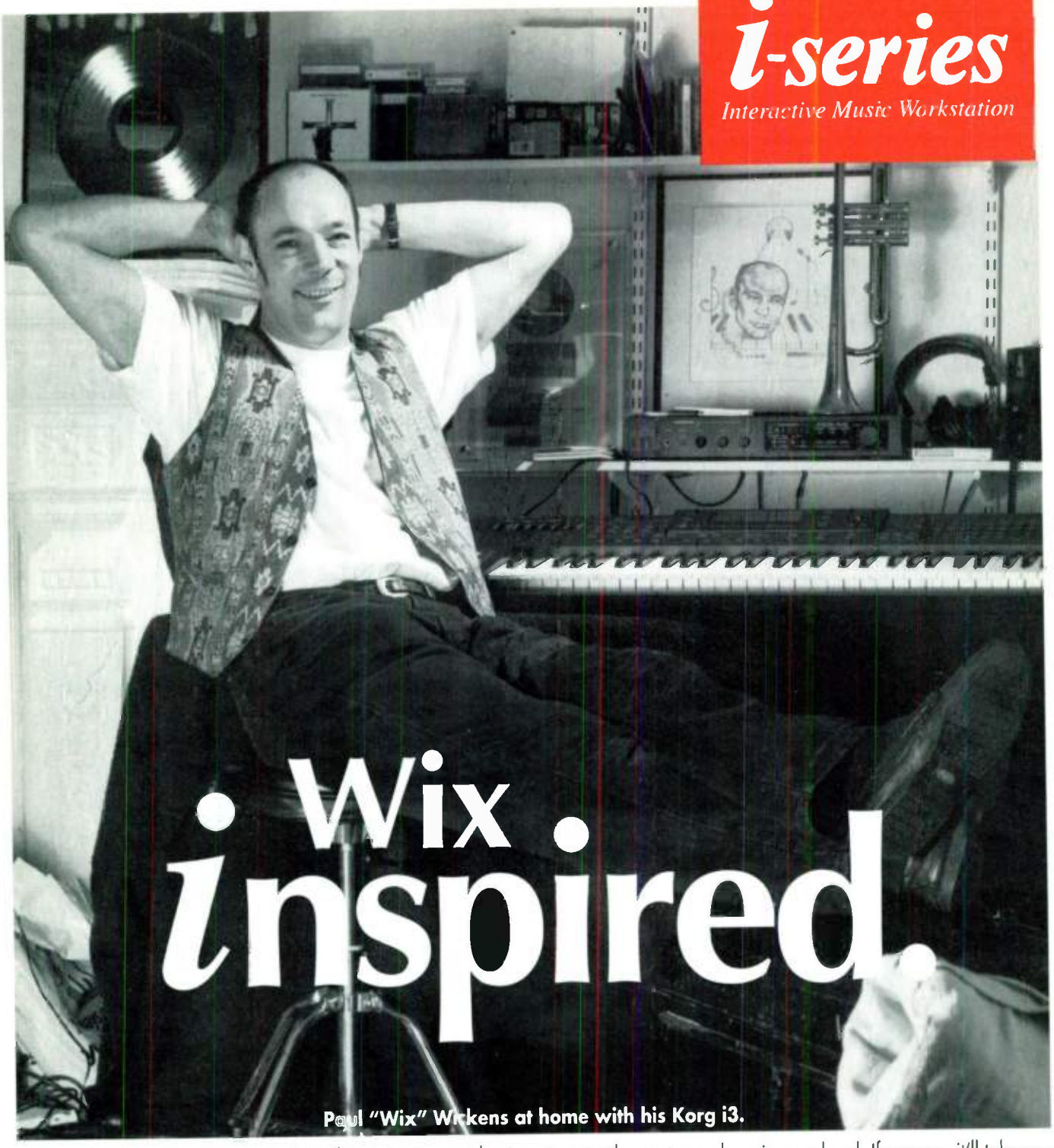
When a connector's thin layer of gold is damaged, base metals are exposed that are susceptible to oxides and sulfides; ProGold dissolves these substances. It also penetrates the plated surfaces to seal and protect the base metals. If an untreated connector mates with a ProGold-treated connector, the solution migrates and protects both.

ProGold is available at 100% concentration with several applicators, including wipes (50/pkg.; $18.95); pen ($19.95); brush ($16.95); 12 ml syringe ($25.95); 25 ml needle ($39.95); 236 ml bottle ($195); and 2 oz. spray ($24.95). It is also sold at 5% concentration in a 5.5 oz. spray ($15.95) for light applications. CAIG Laboratories; tel. (619) 451-1799; fax (619) 451-2799.

Circle #410 on Reader Service Card

i-series

Interactive Music Workstation



• Wix • inspired.

Paul "Wix" Wickens at home with his Korg i3.

It can happen without warning. Something triggers an idea in your head and you want to turn it into music. You need access to sounds, rhythms and styles which can help you shape it quickly before you lose it. That's where Korg's i3–the world's first interactive music workstation–comes in.

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To hear "Wix" play, check out the recently released *Paul is Live* album recorded during Paul McCartney's World Tour. For a video tour of the incredible i3, send $3.95 for shipping & handling to Korg USA, 89 Frost Street, Westbury, N.Y. 11590.

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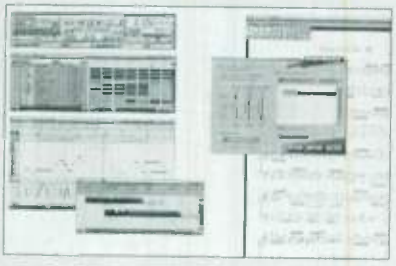

▲ MARK OF THE UNICORN

Mark of the Unicorn is shipping *Performer* 5.0 for the Macintosh ($495; upgrades $99.95). The major upgrade adds a color 3-D look, with extensive use of shading. (The program also runs on a monochrome monitor.) Critical types of information are designated in color. The upgrade also adds MIDI Machine Control.

The Groove Quantize feature lets you create, edit, and apply a set of rhythmic relationships to a sequence, supplying the desired "feel." A slider lets you apply the grooves, dynamically controlling how timing, Velocity, and duration changes are applied. Fifty DNA Grooves from WC Music Research are included.

The program's Cycle Record function provides drum machine-style pattern recording with graphic editing. You can click-and-drag to set Cycle start and end points and auto-punch points. During recording, notes appear onscreen in real time. A library of Drumtrax drum patterns is included.

Performer now lets you edit sequences in a music-notation Page view. A new QuickScribe outline font is included. The algorithms have been enhanced for more accurate rhythmic transcription, and music now can be entered from a tool palette. You can also add page numbers, rehearsal marks, and titles.

Other new features include Bank Select messages, with customizable user patch lists; an oversized SMPTE counter; and Mac AV and PowerBook compatibility. The Split Notes command uses an onscreen keyboard to define which notes are split off to a different track.

Another significant change is that *Performer* 5.0 includes *FreeMIDI*, a Mac system extension that provides interapplication communication and a common clock for compatible programs (including MOTU's *Unisyn* and *Composer's Mosaic*). For example, you can call up patches by name from *Unisyn*, publish and subscribe between *Performer* sequences and *Mosaic* scores, and control the sequencer's transport functions from within the other programs. Mark of the Unicorn; tel. (617) 576-2760; fax (617) 576-3609.

Circle #411 on Reader Service Card

▼ KURZWEIL

Kurzweil is offering K2000 operating system version 3.0 (price tba), which adds a 32-track sequencer with sixteen song tracks and sixteen arrangement tracks. The sequencer supports pattern or linear sequencing, auto-punch, multichannel record, event-list editing, track solo/mute, and mixdown features. You can adjust the amount of "swing" and the record resolution up to 768 ppqn. The event capacity depends on the amount of Program RAM you have installed.

Equally significant is the implementation of a hierarchical file-directory system. K2000 files can be organized into subdirectories, and you can load and save individual objects, such as samples, Programs, and Setups. You can also create lists of files to be loaded with a macro. Finally, drive compatibility has been extended to include a wider range of SCSI drives. Kurzweil Music Systems; tel. (310) 926-3200; fax (310) 404-0748.

Circle #412 on Reader Service Card

▲ GENERALMUSIC

Generalmusic is offering the Turbokit enhancement board ($325) for the S2 and S3 MusicProcessor keyboards. The board expands the number of factory presets from 350 to 500 and adds 100 preprogrammed Performance Combinations. It also adds 512 KB of user memory for saving songs, samples, and setups and expands the Pitch Bend range to ±12 semitones.

In addition to the previous Crossfade Looping mode, sounds can be programmed as Single Oscillator (32-note polyphony) or Dual Oscillator (which uses two separate waveforms for the paired oscillators; 16-note polyphony). New sequencer features include Note Range Filters and the ability to copy a track between songs.

Sample Translator 2.0 is also in the kit. The new version lets you load samples via MIDI Sample Dump or from floppy disk in Akai, *SampleVision, Wave for Windows, Avalon,* and *Sound Designer* formats. Floppy disks can be formatted as MS-DOS or Atari, high- or double-density. Data-compression reduces sample-storage requirements on disk by 12 to 30 percent. The Turbokit must be installed by a qualified service technician. Generalmusic; tel. (708) 766-8230; fax (708) 766-8281.

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©A Models shown with optional handles.

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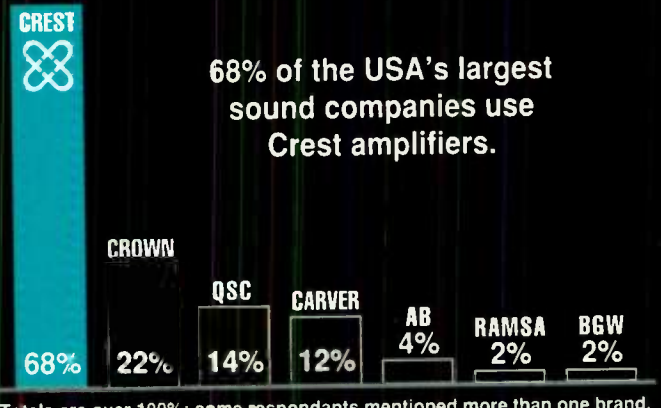

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PRO FILE

Live and Kickin'

Tim O'Brien turns it loose in the studio.

By Anne-Marie Praetzel

Tim O'Brien knows how to charm an audience. Whether it's his melodic voice or ripping licks on the mandolin, people love his performances. So, naturally, when his band the O'Boys cut their first album, *Oh Boy! O'Boy!*, O'Brien wanted to capture the atmosphere of a live gig.

First, he pulled in a few all-stars from the bluegrass world. Virtuoso dobro player Jerry Douglas was brought in to produce the album and play on a few cuts. O'Brien also corralled acoustic-recording ace Bill VornDick to engineer.

Except for a few guest stars, including Mary-Chapin Carpenter on vocals, the album features just three musicians playing stand-up bass, guitar, and fiddle or mandolin, recorded live on the first take. O'Brien wanted to avoid what he calls the "real tweaked" sound of digital, so *Oh Boy! O'Boy!* was recorded on analog tape.

To capture the intimacy of an acoustic performance, the instruments were recorded with tube microphones. "Large-diaphragm tube mics pick up a lot of the air that the instrument pushes," asserts O'Brien. "To me, they help recordings sound more 'real.'" And to produce an even warmer sound, VornDick bypassed the mixing console and recorded everything straight to tape using Sontec, Massenburg, Drawmer, Summit, and Neve preamps.

For the bass, a direct line was run from a Fishman pickup, and a Neumann U47 was positioned near the bottom of the fingerboard. "This [technique] picked up the real acoustic bass sound plus some finger noise for added attack," says O'Brien.

"We also ran the bass through a BBE Sonic Maximizer," adds Douglas. "It makes the sound bigger and really helps out the low end." Guitar was the most straightforward instrument to record. They simply positioned a Neumann KM 54 and a Sanken mic to capture a wide stereo perspective.

Miking O'Brien on mandolin was a little trickier, because his vocals were recorded simultaneously. "We had two microphones on the mandolin and one on the voice, and we were recording it all live, so the sound of the voice got into the mandolin mic, and vice versa. Each one colors the other, so you have to choose the right mics for a wide sound with everything just right."

Fortunately, VornDick possesses a collection of rare, highly coveted tube microphones. For mandolin, he contributed a Sony C-37, as well as a Neumann KM 64—a smaller-diaphragm mic that is great for reproducing the instrument's bell-like highs. The mics were placed a few inches from the mandolin. "You can hear me moving in and out while singing, then moving back in to play. It sounds kind of cool," says O'Brien.

"The one drawback to recording voice and mandolin at the same time is that when a vocal line needed to be fixed, O'Brien had to play the mandolin again, too," notes Douglas. "So if anything was wrong with a vocal or overdub, we tried to fix it quickly, so the strings were the same age, and we remembered exactly where we were on the mic. If you try to patch up a guitar three months later, you'll have to do some major EQ going down."

The O'Boys' efforts to produce a live-sounding album paid off. The final product, while clean and tight, retains the full-bodied, rich, intimate feel of a live acoustic show.

Anne-Marie Praetzel *is a freelance writer and editor living in San Francisco.*

Tim O'Brien

If you've been puzzled about choosing the best synth workstation, a TS keyboard is the answer to all your questions.

Where do I get great sounds with General MIDI compatibility? When it comes to range and quality of sound, the TS is second to none. There are over 700 onboard sounds for every style of music including all 128 GM sounds *(as well as all 9 GM and GS drum kits)* for spectacular sounding playback of any General MIDI input.

Okay. But what about wave expansion? You can load, play, and even edit ENSONIQ's huge library of sampled sounds. With our optional SCSI, you have access to hundreds of Megabytes of samples on CD-ROMs from ENSONIQ and third-party companies. It's easy to get not only new waveforms, but also new sounds.

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Solve the Workstation Puzzle

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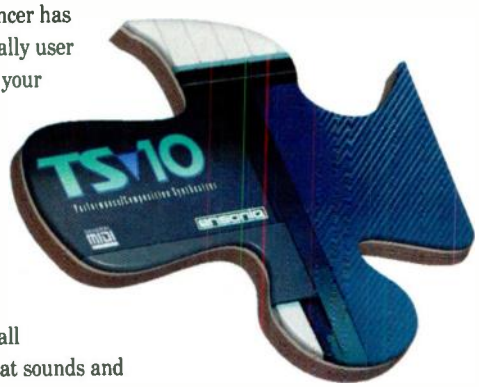

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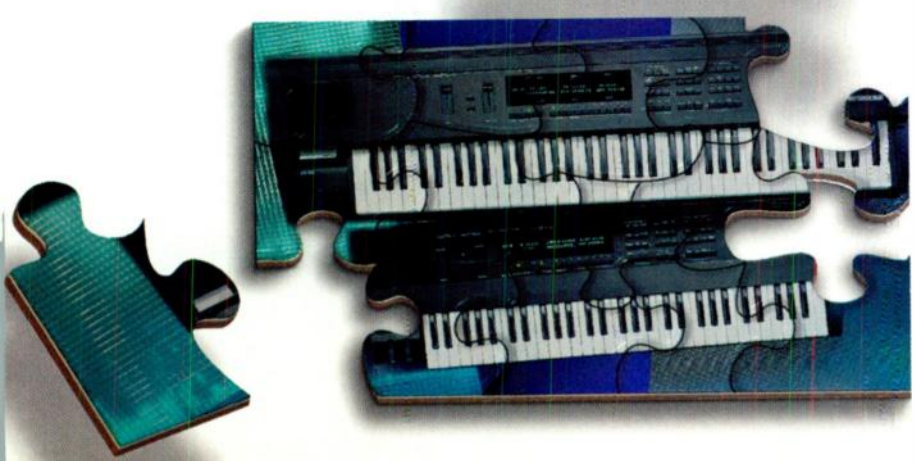

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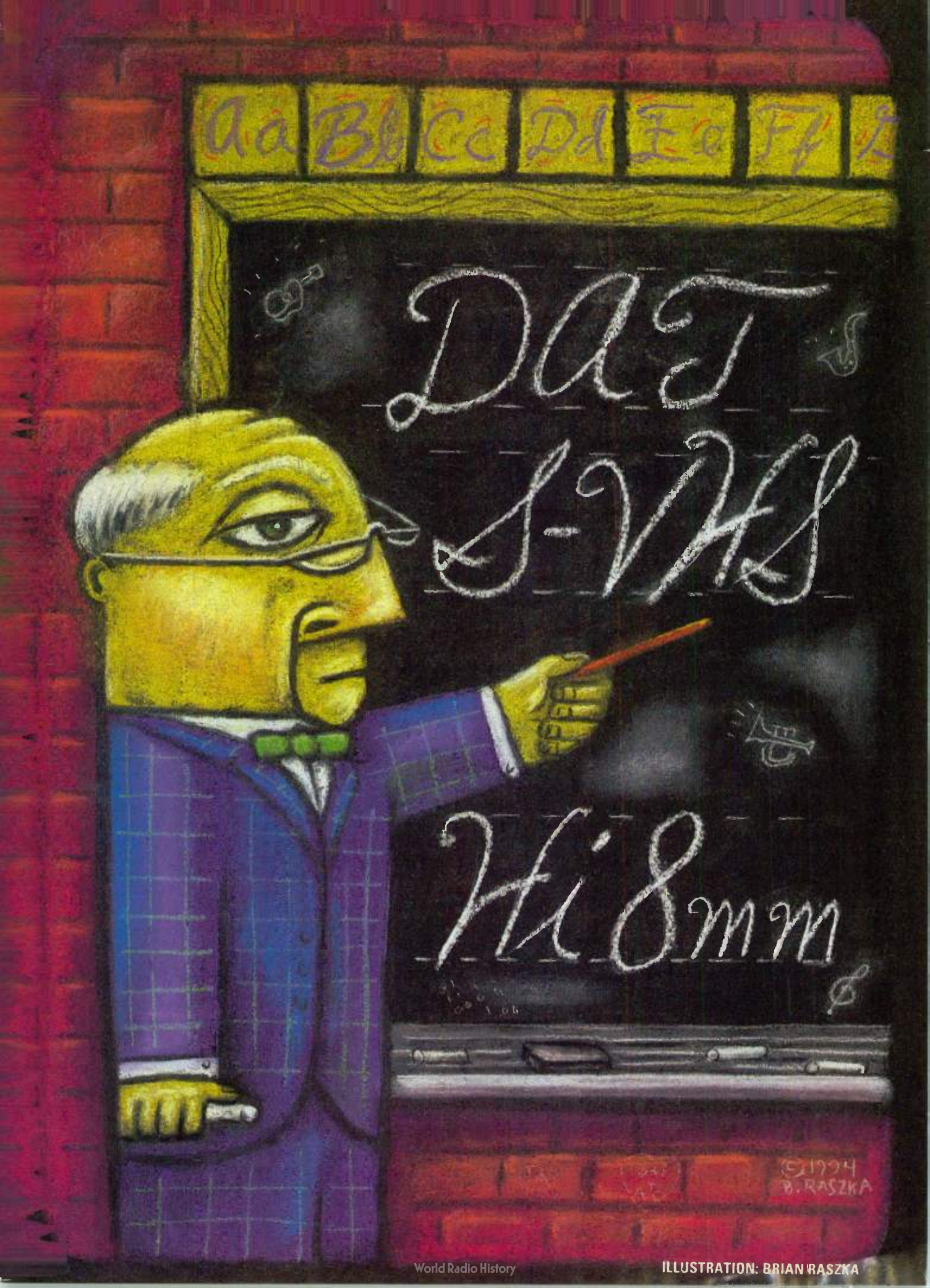

ILLUSTRATION: BRIAN RASZKA

By Mike Pappas

The ABCs of Digital Tape

kay, digital tape is hot. You can't go anywhere without being assaulted by modular digital multitracks (MDMs). Just about every home recordist owns one, wants to own one, or is feverishly saving up to buy one. MDMs have pretty much overrun professional studios, too.

Cost is obviously a major reason for the ascendancy of digital recording technology. Street prices for MDMs often dip below the $3,000 mark, and professional DAT machines can be had for less than $1,000. As a "first step" into the digital domain, MDMs and DAT decks allow analog recordists to enjoy the benefits of digital recording technology while continuing to deal with a familiar entity and old friend: tape. For many musicians, therefore, an MDM makes for a much easier transition to digital recording than a hard-disk recorder. So be it.

A primer on how DAT recorders, ADATs, and DA-88s do their digital deeds.

However, digital tape is *not* analog tape. Duh. The new generation of affordable digital multitracks (and DAT recorders) employ tape quite differently than their analog counterparts. On an analog deck, tracks are laid down to tape in a linear sequence. On a digital deck, tracks are converted into digital data and are then laid down to tape in a series of packets. Unlike an analog recording system, tape width and tape speed don't necessarily bear any correlation to the sonic performance of a digital recording system. What counts is the

The ABCs of Digital Tape

manner in which the data is converted and stored and which error-correction system is used. In addition, MDM tapes must be formatted—just like the floppy disks used by your computer—before recording can begin. To bring you up to speed on these and other characteristics of digital-tape recording, we've compiled a basic look at three formats: DAT, S-VHS (employed by the Alesis ADAT and the Fostex RD-8), and Hi-8 (used by Tascam's DA-88).

DIGITAL BASICS

Recording onto analog tape is a relatively simple procedure. Your music is amplified by the electronics in the tape deck, and then the signal is run through a tape head that records it to magnetic tape. No sweat, except that analog tape isn't exactly a perfect storage medium. Sonic anomalies such as wow and flutter, tape noise, tape coloration, and distortion can torpedo your recorded masterpieces. Although noise reduction and high-output tapes such as Ampex 499 and 3M 996 have allowed analog tape specs to run neck-and-neck with those of digital, analog tape *still* changes the way your music sounds. If you don't believe me, try bouncing an acoustic guitar track six times on a ¼-inch, 8-track analog machine and listen to what's left.

Digital recorders sidestep many of the sonic problems associated with analog recorders. Frequency response is near perfect, distortion is often far below meaningful measurements, and dynamic range is vast and uncompromised by audible tape hiss. For recording engineers, a major benefit of digital is "what goes in, comes out." There is no tape coloration; whatever the microphone captures is reproduced on digital tape (or hard disk).

This magic is achieved by sampling sound waves and digitizing them into strings of ones and zeroes (see **Fig. 1**), the binary language of computers. It takes a ton of digital samples to reconstruct a sound; in the audio world, the current sample-rate frequencies are 44,100 or 48,000 samples per second (44.1 or 48 kHz). The reason so many samples are needed for audio reproduction is explained by the Nyquist Theorem. This basic tenet of digital audio specifies that the highest reproducible frequency in a digital system is equal to or less than one-half of the sampling frequency. So, for your digital recorder to reproduce the full 20 Hz to 20 kHz spectrum of human hearing, its sampling rate must be twice the highest input frequency, or 40 kHz.

The Tascam DA-88 uses Hi-8 tape to record eight tracks of digital audio.

Because DAT recorders and MDMs employ the standard sample rates of 44.1 kHz and 48 kHz, the highest theoretical frequencies these machines can reproduce are 22.05 kHz and 24 kHz, respectively. If an input signal exceeds one-half the sampling rate, an ugly, whistling distortion known as aliasing occurs. To prevent aliasing noise, digital recorders employ filters that stop frequencies higher than one-half the sample rate from entering the system.

The accuracy of a digital system is defined by its bit resolution. The number of available bits describes the number of "steps" the digital system uses to represent signals, in exponential increments. A 1-bit (2^1) system offers but two steps and can only represent a signal as "off" or "full volume." An 8-bit system, however, offers 256 steps (2^8). These steps bear a direct relation to audio quality. The higher the bit resolution, the more accurate the digital reproduction.

To best complete the task of capturing all this data, the DAT, ADAT, and DA-88 formats employ a helical recording process that was developed by Ampex in the 1960s for recording video (see **Fig. 2**). The tape is pulled from its cassette and is partially wrapped around a cylindrical drum housing the rotary record and playback heads. These heads are tilted so that the data is recorded in diagonal bands known as helical scans. One advantage

DIGITAL INFORMATION

Because this article was structured as a primer, its information is necessarily basic and limited. If you want to learn more about digital recording and digital-tape formats, contact Mix Bookshelf (tel. [800] 233-9604 or [510] 653-3307) and ask for a free catalog of pro-audio publications. A great resource for MDM users is *Modular Digital Multitracks: The Power User's Guide* by *Mix* magazine's senior editor, George Petersen. The book is $29.95 (plus shipping and handling) and can be ordered through Mix Bookshelf. In addition, **EM** has published several articles on digital recording. Here's a quick list of recent MDM and digital-recording coverage.

Alesis ADAT review	October 1992
Alesis BRC review	November 1993
"All For One"	April 1994
"Brave New World"	October 1993
"The Digital Debate"	August 1993
"The Digital Home Studio"	October 1992
"The Digital Puzzle"	May 1993
"Naughty Bits"	November 1993
"Random Access"	January 1994
"Recording Musician: The Digital Domain"	August 1993
Tascam DA-88 review	October 1993

of helical recording is that it doesn't use a lot of tape. By spinning the heads against the tape at an angle—and at high speeds—the system creates the equivalent of a high tape speed, even though the tape itself is actually moving quite slow compared to analog recorders. For example, a 120-minute DAT tape is just 90 meters long. The same amount of recording time on a ¼-inch, 2-track analog machine at 15 ips would require a tape 9,700 feet long at eight times the cost. Let's look at how each tape format utilizes the helical recording process.

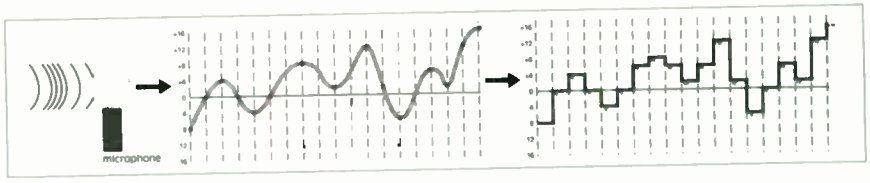

FIG. 1: An analog signal being converted to digital data. (Courtesy Tascam.)

DAT

The DAT format is stereo, which means both tracks are recorded simultaneously (see **Fig. 3**). Otari's DTR-90 is the only current DAT machine that allows you to record each track individually. An A-to-D (analog-to-digital) converter transforms the analog signals to digital data. The data for both channels is then interleaved to provide better fault tolerance for errors. Interleaving is an error-avoidance process that separates the sequential data samples generated by the A-to-D converter and shuffles them around to distant, *nonsequential* positions on the tape. By throwing data (in a figurative sense) to the ends of the earth, this process makes it possible to reconstruct continuous valid data if a catastrophic tape drop-out blitzkriegs the datastream. The machine simply looks for the data stored far away from the faulty tape location, reshuffles it into sequential data, and fills in the missing samples to reconstruct the sound.

Due to the nature of the helical recording process, data may have to be temporarily stored until the heads are in the proper position to write data to the tape. Random-access memory (RAM) is used to buffer—or hold—the data until the record heads are in the proper position to write. The RAM buffer also allows the recorder time to enact error correction and read and rewrite positional data such as start IDs (the numbers that "tag" each new recording, similar to program numbers on a CD player). DAT machines use Auto Track Finding (ATF) to steer the heads to the correct position to read or write the data onto tape. ATF is also used on Tascam's DA-88 and digital video formats. Maximum record time on the DAT format is two hours.

If you are considering buying a DAT deck, keep in mind there are two big differences between consumer DAT recorders and professional models. First, most consumer machines limit you to a 48 kHz sample rate when recording from the analog inputs. This limitation can be a problem if you want to make CDs, because CD plants require a DAT master with a 44.1 kHz sample rate. Sample-rate conversion can be done in the digital domain, but

The ABCs of Digital Tape

this procedure can generate audible artifacts.

The second problem with consumer DAT machines is the Serial Copy Management System (SCMS, pronounced "scums"). This wacky scheme was cooked up by the U.S. government and the Record Industry Association of America (RIAA) to prevent consumers from making multiple digital copies of copyrighted material. By law, SCMS is incorporated into all consumer machines to prevent "pirating." I doubt that SCMS has stopped any pirates, but it *will* stop you from making a digital copy of a digital copy. So, if your original master gets damaged and you try to make a digital copy of your back-up, the machine won't let you.

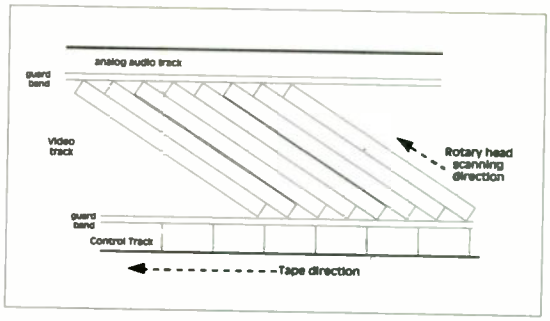

FIG. 2: The helical recording process was developed to service the needs of video reproduction. (Courtesy Tascam.)

Most serious recordists avoid these two "features" by simply buying a pro DAT recorder. (Professional AES/ EBU digital inputs and outputs don't recognize SCMS.) More often than not, the extra few bucks you'll spend for the professional machine becomes a real bargain in the long run.

Alesis opted for the S-VHS tape format for its ADAT.

S-VHS

The Alesis ADAT 8-track digital format is based upon a modified, ½-inch, S-VHS video transport. The ADAT runs the tape at three times (3¾ ips) the normal VHS video speed, which means that a T-120 cassette delivers 40 minutes of recording time. This speed increase is needed to get the spacing necessary to accommodate the ADAT's 100-micron-wide record heads.

The ADAT recording process starts by converting an analog signal to digital. Eight 16-bit linear, Delta-Sigma A-to-D converter chips are employed to process each of the machine's eight

(continued on p. 33)

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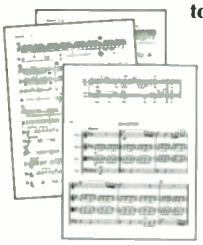

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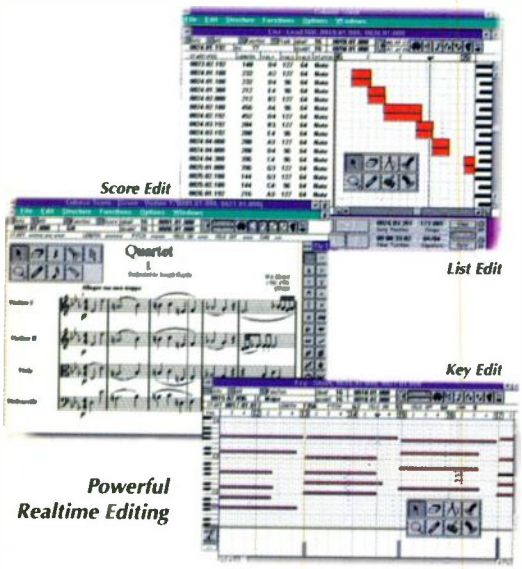

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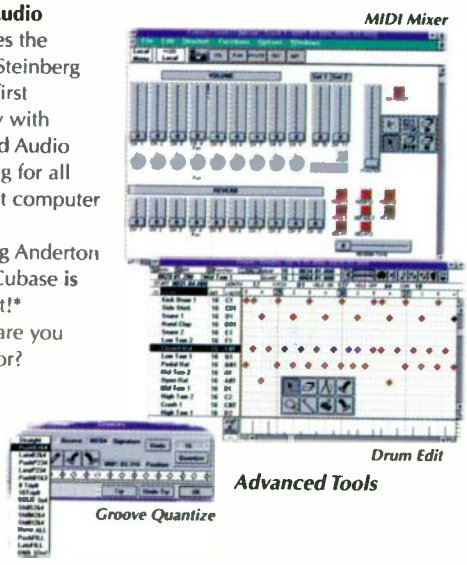

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The ABCs of Digital Tape

(continued from p. 28)

tracks. The conversion process uses a 64-times oversampling technique—oversampling is a process in which each audio sample is read more than once—to improve fidelity and avoid the use of the steep frequency roll-off filters needed to prevent aliasing. Eliminating these problems with conventional converters would require a 100 dB/octave filter at 20 kHz. Such a massive filter can be quite audible, as it often induces a tremendous amount of phase shift in the signal being converted. By sampling at 64 times the normal sampling rate, oversampling "tricks" the converters into thinking they are working at a higher frequency. A 20 kHz signal now looks like a 125 kHz signal, which is far bigger than one-half the typical sampling frequencies of 44.1 kHz and 48 kHz. With the aliasing problem pretty much under control, a gradual sloping filter can be used, which results in significantly lower phase shifting and much better sound quality. Now where do all of those extra samples go? Because they are redundant, they are simply tossed out.

As with the DAT format, the ADAT uses RAM buffers to store data until the record heads are ready to write. The two record heads write each of the ADAT's eight tracks as a separate block of data. Each second, 800 separate data blocks are written, and the packets are scattered to different places on tape to avoid errors. A linear control track, which is recorded onto tape during the formatting process, is used to sync the head location to the recorded tracks.

On playback, the linear control track is used to control the tape speed, while the rotary head is synched to pulses coming off the helical scan. Again, the busy RAM buffer is used to allow time for error correction and deciphering of track information before the signals are routed to the digital-to-analog (D-to-A) converters. Obviously, you must convert those zeroes and ones back to analog before our analog ears can hear any sounds. Eight 18-bit linear, D-to-A chips are used for the conversion. Oversampling is not employed during the D-to-A conversion.

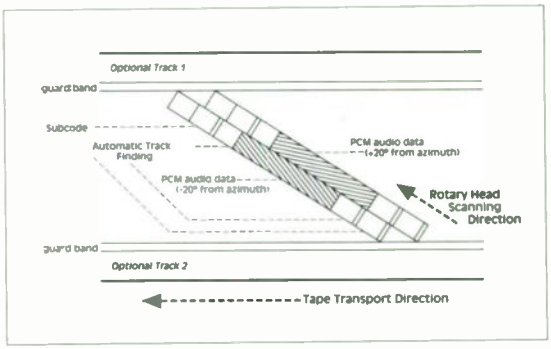

FIG. 3: A look at how helical recording was adapted for the stereo DAT format. (Courtesy Tascam.)

HI-8

The Tascam DA-88 is based upon the Hi-8 mm video format. The DA-88

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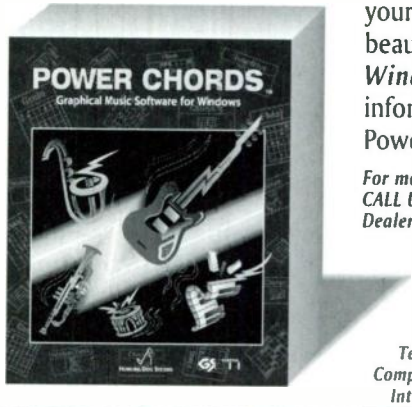

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Mark Hanen, ***Computer Paper,***
June 1993

transport runs approximately 11 percent faster (15.9 mm per second) than the standard Hi-8 video transport, and therefore delivers a recording time of 108 minutes from a 120-minute cassette. The DA-88 platform uses metal-particle tape.

Eight 16-bit linear, Delta-Sigma, A-to-D converters are used to convert analog signals to digital data. As with the ADAT format, 64-times oversampling is employed to improve fidelity. Once again, RAM buffers are used to hold the data until the record heads are in the correct position to write. Logic chips add error-correction coding and interleave digital data. The data is then shipped off to the two 20.5-micron-wide record heads. ATF, also used by DAT recorders, is used to synchronize the heads to the tape. The ATF signal is recorded along with absolute tape time information during the formatting of the tape.

During playback, the two 20.5-micron-wide read heads scan for the ATF signal to synchronize them to the recorded tracks. The data from the read heads is then fed into RAM buffers where error correction is applied. From the RAM buffer, the data is sent to the D-to-A converters. Eight 18-bit linear, D-to-A converter chips running 8-times oversampling are used to convert the data back to analog.

GLOBAL SURVIVAL

So now you know how each machine takes your beautiful music and turns it into beautiful data. But there's more to the story. No matter which format you use, there are a few survival tips that you should be aware of when you make the leap to digital tape. With analog gear, the worst-case scenarios involve signal dropouts, tape shedding, or a loss of high-frequency performance. It's a different situation with digital audio. Tape mistreatments or malfunctions can scramble those zeros and ones until no amount of error correction can save your signal. In other words, your magnificent master is rendered unplayable, gone, dead, bye bye Birdie!

The ABCs of Digital Tape

So don't be foolish. The trunk of your car is not a suitable place for digital-tape storage. Keep digital tapes in a cool, dry place. Don't subject them to temperature extremes, don't toss them around the studio (a good bang could irreversibly damage both tape and shell), and don't ever touch the tape surface. Also, never disassemble the cassettes, and don't set them near power amps, speakers, or anything that generates magnetic fields.

Now, how many of you have lost data on your computer because you didn't have a backup? (Don't be bashful; raise those hands!) Computers and digital-audio decks store data in a similar fashion, and both are susceptible to catastrophic data loss. Therefore, *always* back up your MDM tapes. This is critical. You may have invested hundreds of hours recording your tunes onto tape. Don't risk losing everything if a transport has a hiccup and munches your tape. All formats (DAT, ADAT, and DA-88) support full-digital backup if you have access to two machines. Find a "back-up buddy" with the same machine and get together on a regular basis to do back-ups. Unlike dubbing an analog tape, you won't suffer any loss in sonic quality when you duplicate a digital tape. Believe me, it's worth the time and trouble to ensure that you'll never lose a project.

DAT has become the mixing and delivery standard for stereo-master tapes.

END BITS

Digital tape can be a beautiful thing. No matter which format you choose, pristine audio is your reward. And now that you understand the basics of how analog sounds are captured on digital tape, you (hopefully) can step into the digital age with confidence. Although analog loyalists still crow about fatter, warmer sounds and the proven robustness of the medium, digital is where it's at in terms of audio performance, ease of use, creative capability, and tape cost. So what are you waiting for? Investigate what DATs and MDMs can do for *your* music.

(Thanks to *Mix* senior editor George Petersen.)

Mike Pappas *is a 22-year veteran of the pro audio business. His engineering credits include the Kronos Quartet and various local Denver groups.*

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Electronic Musician 2/94

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Sound on Sound (UK/Europe) 12/93

32•8 shown (instead of 24•8) because we had a cooler picture of it.

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Electronic Musician 2/94

"**Amaz-ing. Beautiful. Sexy.** I've been waiting for six years for someone to come out with a mixer like this." J.C., Charlotte, NC

"Replaced a $20,000 console with the 24•8. **Your console kicks butt over my old one.** I love the EQ, the headroom and even the pans." D.C., Burbank, CA

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MIX magazine 2/94

"When I read about your 'quiet' fan in your power supply manual, I almost fell over. When I didn't hear it, I fell to my knees. **When I brought up fader after fader and still heard nothing, I almost blacked out!** Who in the world EVER realizes that audio gear must be **quiet**? I love you people." D.S., Palmdale, CA

"Used a competitor's console while waiting for your 8•Bus and will never use the other board again. **Yours is quieter, has better mic pre's, better EQ, more logically laid out, much cleaner sound and better quality construction.**"
P.P., Salt Lake City, UT

"The back of the board has 24 submaster/tape outputs incorporating a **triple bus system** normalling your submaster to tape ins on the multitrack. When you send a signal to submaster 1 output, for example, it appears at submaster outputs 1, 9 and 17, which **simplifies operations** with 8-, 16- or 24-track recorders."
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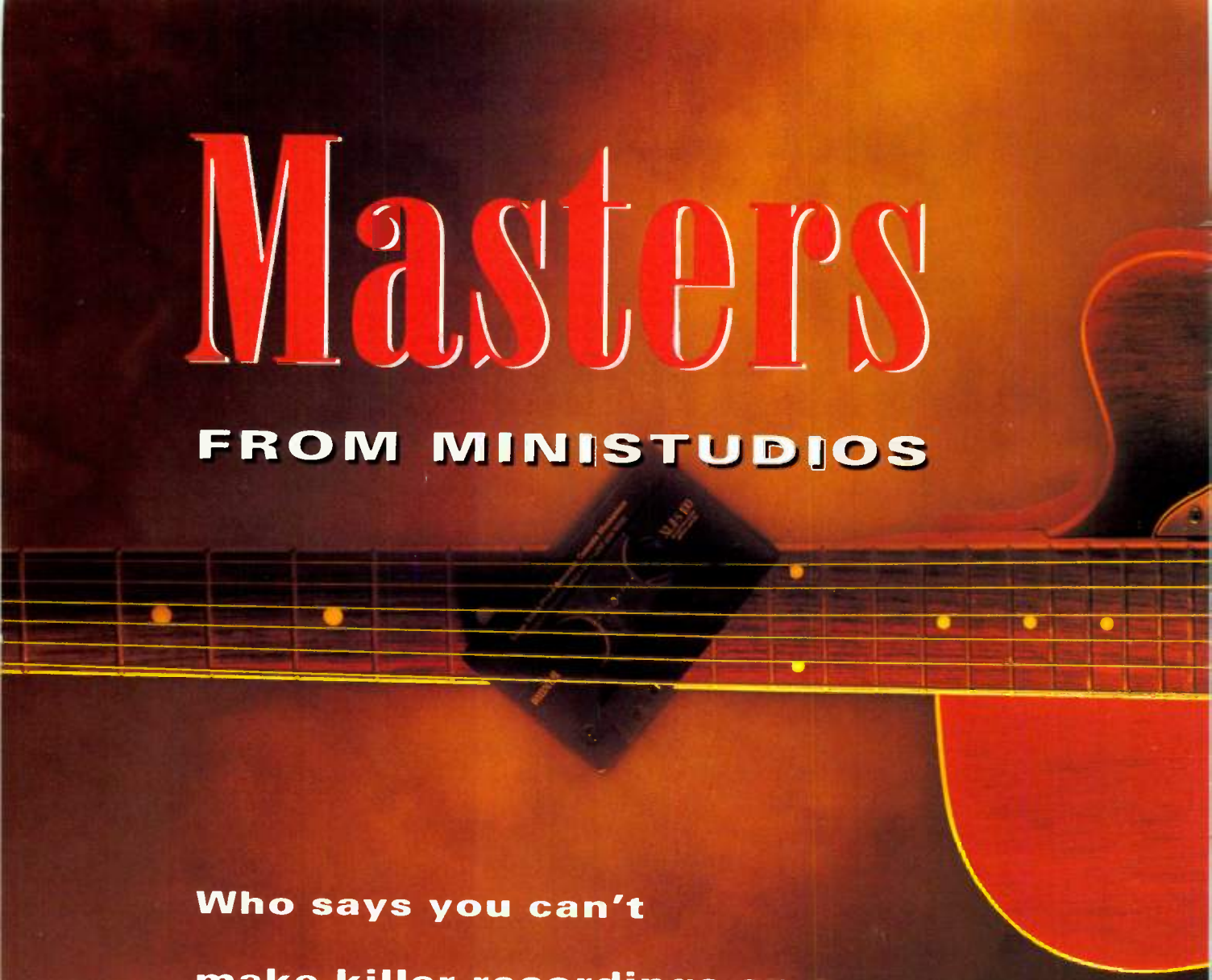
FROM MINISTUDIOS



Who says you can't make killer recordings on a cassette multitrack?

A few years ago, a lame TV talent show called *Star Search* had America's wanna-bes jumping through hoops to snatch a few minutes of televised glory. (Or maybe the attraction was meeting Ed McMahon, who hosted the program when not acting as Johnny Carson's human laugh track.) Scores of singers, bands, and instrumentalists paraded across television screens every week, but stepping into the glow of the *Star Search* spotlight was not easy. Musicians had to send demo tapes to the show's producers to be considered for extremely competitive regional auditions.

Many of those demo tapes—hopeful tickets to fame and fortune and a handshake from Ed—were recorded on cassette ministudios. I know. I mixed bucketfuls of them. Entrants often sought out commercial studios or independent engineers if they feared their home mixes wouldn't have enough zing to impress the talent scouts.

While many of the home-produced cassette demos sounded predictably awful, some exhibited enough punch and shimmer for release on CD. The best tapes rivaled the sonic quality of

BY MICHAEL MOLENDA

Photograph by Robert Perry

SERIOUS FUN.

SERIOUS. Like for starters: 160 great sounding Tones (128 General MIDI compatible, plus 32 unique to the KC20), crystal-clear sound quality thanks to a 16-bit DAC, a built-in IBM/MAC/NEC Serial Computer Interface requiring no external interface other than a cable, 64 User-Definable Patches that store splits, layers and parameter data for the Digital Reverb and other effects, 7 killer Drum Kits each with incredible varieties of sound textures. Kawai's been packing power into small packages for some time now, but this time we've even outdone ourselves: the KC20 is one serious machine.

FUN. Like you've never had before, because the KC20 comes with built-in pegs that allow you to strap it on and take off to some places you've never been: like center stage. With a KC20 you're no longer chained to a rack of keyboards: the elegant slim-body design and incredibly light weight (just 9.1 lbs) allows the KC20 to be played just like a remote keyboard — and unlike most remotes, it not only has a full 61-note keyboard, it also looks and functions like a true keyboard instrument, not a space probe.

Isn't it time you had some serious fun with your music? And at just $699.00 retail, the KC20 is seriously the most bang for a buck you're going to find at your dealer's. Check it out today. Your guitar player may hate you for it, but hey, it's about time they shared some of the limelight.

KAWAI

Digital Magic.

anything recorded in a midlevel pro studio. Thanks to *Star Search,* I cured myself of the audio world's common bias that cassette ministudios are incapable of producing master tapes.

But this doesn't mean audio nirvana is automatic, or even easy. Coaxing master-quality audio from the notoriously hiss-infected cassette medium requires planning, patience, and some helpful pieces of gear. The following tips and tricks were compiled during my experience with the *Star Search* ministudio minions. As long as you promise not to resurrect the TV talent show, you may use them with my compliments.

PROTECT YOUR TAPE

Remember the saying, "A chain is only as strong as its weakest link?" Well, if you use cheap cassette tape in your ministudio, you can kiss any chance of recording great sounds goodbye. The sonic benefits of top-quality tape should be obvious, but some recordists insist on shaving a few bucks off their demo costs by buying variety-store bargain brands. Small wonder their productions sound muddy, noisy, and lifeless. When good-quality cassettes cost no more than four dollars each for 90-minute lengths, there's little sense in purchasing subpar formulations just to save two or three bucks. Don't trust your wallet to judge a tape's audio performance.

Ministudio manufacturers often recommend cassette types in their owner's manuals, so pay attention to their suggestions. As a rule of thumb, use chromium dioxide (Type II) cassettes. My personal favorite is Maxell's XLII-S formulation, because it lets me slam down extremely hot input levels without audible distortion. You may have your own favorite tape—after all, the perception of sound quality is subjective—but the idea is to experiment until you find a tape that really knocks your socks off. Don't settle for less than brilliant audio quality.

Once you've made an informed tape choice, there are a couple of pro studio tricks you can use to maximize performance. Before you record *anything* on a brand new cassette, "break" the tape by fast-forwarding to the end of the spool, then rewinding it back to the beginning. This straightens out uneven factory windings and guards against audio drop-outs due to tape crinkles. It's also a good test for spooling malfunctions. If the tape sticks or sputters during fast-forward and rewind, use it to record rough mixes or music for your Walkman. Do not use a cranky cassette in your ministudio; you'll probably get 90 percent of your project completed before the tape jams for good. If that happens, say *adios* to weeks or months of creative sweat.

You can also optimize tape performance by being extremely careful about storage. Audio professionals are a paranoid bunch, because they've seen the wildest, most unpredictable whims of chance destroy too many master tapes. So, although some would consider it overkill, I always store my cassettes *tails out* to guard against print-through. Print-through is an anomaly caused by a tape's magnetic particles bleeding onto adjacent layers of tape. The effects of these traveling particles are typically audible as "ghost" echoes. Sometimes these echoes can sound cool, like reverse reverb decays, but more often they are sonic nightmares that compromise clean tracks.

Tails-out storage is easy. When you're finished recording, simply fast-forward the tape to the end of the cassette. The benefit of tails-out storage is that any print-through often materializes at the beginning of a track, where it can be easily muted during the final mix or edited out in the mastering process.

I shouldn't have to warn against leaving master cassettes on top of speakers, on window sills, or inside car trunks. But I will, because dunderheaded recordists still do these things, and their masters still get trashed. If you're really serious about improving

dbx's Model 296 Spectral Enhancer includes hiss-reduction for cleaning ministudio masters.

the sonic quality of cassette masters, you must take care of the cassettes themselves.

KNOW YOUR MACHINE

All ministudios are not created equal. Some models have absolutely ripping EQ, while others offer merely adequate tonal control. And while most ministudios are pretty rugged—after all, they are supposedly designed for carting around—some are tougher than others. All in all, there are many factors, from construction to quality of parts to owner misuse, that can affect a unit's performance. But one factor remains constant: Coaxing truly wonderful sounds from a cassette multitrack means getting intimate with the machine's good *and* bad qualities.

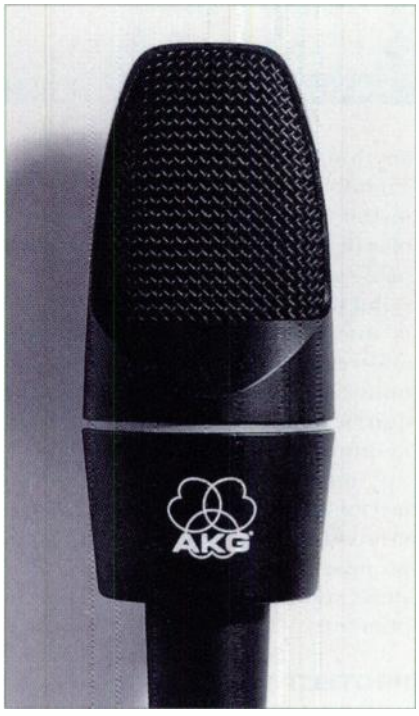
Professional recording engineers can determine the health of an analog reel-to-reel multitrack by using test tones to check input and output levels, tape bias, and other factors critical to audio performance. Ministudios don't offer the tools for fiddling with level and bias adjustments, but that shouldn't stop recordists from evaluating their sound quality.

For example, how much input level is too much? Don't become an unwitting slave to your VU meters. Just because a signal registers "in the red," doesn't mean that it automatically distorts. It is important to determine exactly how far your machine will let you go before it munches signals. This knowledge is especially critical because hot signal levels can minimize audible tape hiss.

Here's a simple way to test your ministudio's input tolerance: Record a number of sounds at various VU levels, from red-lining to barely registering. For best results, use sharp, clean sounds such as unprocessed piano and snare samples. If your ministudio has defeatable noise reduction, run a full test with noise reduction and another without. Some instruments, such as drums and loud guitars, often sound better recorded at high input levels *without* noise reduction. Tape saturation can enhance sonic impact, but you have to know where to stop short of distortion levels.

Listen to the signals that were recorded pinned at "red" levels, and take note of the levels that are definite distortion zones. Keep in mind that signal peaks at these levels may be okay. Next, list the input ranges where signals sound clean, brilliant, and uncompromised by audible tape hiss. Finally, take note of low VU readings where weak signal levels are overwhelmed by tape hiss. With some effort, you have charted a VU meter map of your ministudio's optimum input levels and sonic hazards.

This is an admittedly primitive and basic method of determining a recorder's audio limitations, but it works. Keeping input levels within your machine's ideal range not only improves audio quality, it ensures consistency. It's also a good idea to run a quick input-level test whenever you're recording an unfamiliar or unconventional instrument. I once engineered a project for jazz legend Pharaoh Saunders in which he wanted to record some Tibetan temple bowls. At my usual recording levels of +2 dB or higher, I couldn't get a clean sound. The complex harmonic structure of the bowls completely saturated the tape at high input levels. When I backed the input levels down to -5 dB, the bowls sounded gorgeous. The moral here is: Trust your ears.



AKG's C3000 is an affordable condenser mic that can improve the sound of acoustic tracks.

And speaking of trusting your ears, don't forget to subject the ministudio's EQ to an extremely critical listening test. If the EQ sounds cheap or brittle, don't use it. Instead, brighten or fatten up your synth patches with programming tweaks. For acoustic instruments, optimize your mic placement to capture great sounds without the aid of onboard EQ.

If you just can't live without equalization, consider purchasing a pro-quality outboard unit. A stereo parametric or graphic equalizer gives you two channels of precise tonal control. The most flexible way to use an outboard EQ is to connect it to the channel insert points on your ministudio. This method allows you to process individual tracks, limited only by the number of separate EQ channels available.

If your machine doesn't have insert points or direct (tape) outs, using the equalizer on individual channels during mixdown is impossible. You can, of course, *record* using outboard EQ; just route the signal to the equalizer before patching into an input channel. You

The new SV-4100 DAT machine from Panasonic is an example of an important mastering tool. Ministudio submixes are cleaner when bounced between digital and analog cassette media.

Imagine Getting Slammed In The Chest With A Sledgehammer.

Now that you know what kind of low end these amps have, let's talk about why. Crown amplifiers are engineered with a damping factor in excess of 1000 (10 Hz to 200 Hz) while most amps are lucky to manage 50 to 100 over the same frequency range. The result of this high damping factor is incredible speaker control for some of the tightest, bone-rattling bass you've ever felt.

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can also EQ the entire mix by routing the ministudio's left/right bus into both channels of a dual or stereo equalizer.

GET A GOOD MIC

I've heard musicians say that you shouldn't waste a good microphone on a ministudio. Well, phooey! Most cassette multitracks have a frequency response of at least 40 Hz to 16 kHz, and that's certainly enough tonal spectrum to merit using a quality mic. Also, pro-level mics typically reproduce cleaner, truer sounds than semipro models.

If you record a lot of vocals, I recommend a condenser mic. Unfortunately, they're not cheap. Expect to cough up between $700 to $1,500 for a pro-quality, large-diaphragm microphone. (For a comparison of studio vocal mics, see "In Your Face" in the May 1994 **EM**.) If that tariff is too rich, small-diaphragm models such as Shure's Beta 87 and AKG's Tri-Power condenser series are available in the $400 to $600 price range. Condenser mics require power, so if the model you pick doesn't accept batteries, you'll need a phantom power supply.

The good news is that every dollar used to purchase a condenser mic is money well spent. You can't lose! A quality condenser mic adds luster to more than vocal tracks. Acoustic guitars, pianos, flutes, saxes, trumpets, and other instruments that produce either complex waveforms, large dynamic ranges, or subtle tonal shadings truly come alive when miked with a condenser. (Shameless plug: If you want help maximizing your miking, order the **EM** book *Miking The Ultimate Demo*, available from Mix Bookshelf, [800] 233-9604 or [510] 653-3307.) If you decide to move up to an ADAT, DA-88, or hard-disk recorder, you'll already have a suitable tool for taking advantage of that crystalline digital resolution.

SANITIZE YOUR TRACKS

Obviously, all this trouble is worthless if you put noisy sounds *into* your ministudio. Any audible hiss inherent in your machine or tape formulation will be increased when unclean signals are added to the sonic ruckus.

Listen critically to every sound you record. If a synth patch is noisy, don't just shrug your shoulders: gate it! Noise gates are handy tools for serious recordists, because they shut down signals that appear below a user-set threshold. Audible hiss, hum, and assorted

MINISTUDIO REVIEWS

If you're interested in purchasing a cassette multitrack, or moving up to a higher-end unit, **EM**'s latest buyer's guide was in the June 1993 issue. In addition, we've published reviews on the following models:

Fostex 280	Nov. 1991
Fostex 380S	March 1994
Fostex X-28H	Jan. 1992
Marantz PMD 740	Dec. 1993
Tascam 488	June 1991
Tascam 688	Dec. 1989
Tascam Porta 07	Nov. 1993
Vestax MR44S	Feb. 1992
Yamaha MT120	Sept. 1992

other noises typically occur at lower dB levels than the signal being recorded, so cleaning tracks is usually very easy. A noise gate cannot diminish hiss when the fundamental sound is audible—the signal level of the instrument keeps the gate open—but the clatter of the track should mask the noise. Noise gates are great for keeping introductions clean and shutting down noise when an instrument (or other sound) is not playing. Excellent noise gates are made by Symetrix, Aphex, and other companies, and dbx's Project 1 series offers a number of affordable dynamics processors.

If hiss is still audible when the tracks are playing, a single-ended noise-reduction unit—such as Rocktron's Hush and dbx's 563x Silencer—can save the day. These frequency-dependent equalizers "audition" input signals and cut high frequencies not present in the program material. Because hiss is typically found at a higher frequency than most of the sounds you record, the automatic EQ tweaks diminish noise. Although some high-frequency definition is necessarily lost when employing one of these devices, I've never found that processed sounds became dull or lifeless. And I'm willing to sacrifice a few highs to get rid of obnoxious hiss. Clean tracks rule!

DO DAT BOUNCES

Everyone always needs more tracks. I've witnessed pro sessions where the artist complained about being limited to *only* 48 tracks. Unfortunately, in the cassette medium, doing submixes and bounces to free up tracks also increases tape noise.

A solution for avoiding added noise is to bounce your tracks to a DAT machine. Obviously, the sonic quality of the digital medium is superior to an analog submix, but there is another advantage. After you submix your tracks to stereo (or mono), don't bounce them back to the same cassette. Unwrap a new cassette for your DAT (submix) to ministudio transfer. This method not only ensures fresh, clean tape for your submix, but leaves you a cassette safety copy of the previous tracks.

If at any time you determine a track is subpar, you can simply go back to the original cassette multitrack master, recut the part, and do another DAT submix. Of course, this also means recutting every track you recorded after the original submix, but it's worth it if the final product is improved. Hey, cassette tape is cheap and so is your time. Do whatever it takes to produce the best tracks possible.

MIX CLEAN

To steal a riff from Gertrude Stein, "The final mix is the final mix is the final mix." In other words, everything you've done to ensure sterling tracks will be for naught if you screw up the final product. The mixdown is where a lot of recordists go astray. Clean tracks are often buried in reverb from an inexpensive and noisy effects box, or equalized to death. To avoid butchering your master tape, listen critically to some favorite CDs to learn exactly what comprises a professional mix.

Unfortunately, self-education is only half the battle. Make sure that your mastering deck is well maintained and working at optimum specs. If not, borrow or rent a high-end cassette deck, analog reel-to-reel recorder, or DAT machine that can produce brilliant audio. You can even mix to two tracks of a friend's modular digital multitrack. In addition, don't use effects processors that exhibit poor audio quality. A noisy reverb unit with thin, metallic timbres can wreck a good recording. Once again, borrow or rent a pro-quality unit for important mixes.

If the tape-hiss factor remains a problem, insert a dual (or stereo), single-ended noise-reduction device into the left/right bus or between the ministudio and mastering deck. When I mixed all those *Star Search* demos, I used these units as the last defense against noise.

Always confirm the clarity of your tracks by checking mixes through quality headphones.

The mixes always turned out amazingly clean. In fact, I often use a touch of single-ended noise reduction, even when mixing digital tracks. When you're a clean-audio fanatic, every little bit of polishing helps.

FINAL FADE

The *Star Search* debacle was a good lesson for me. Since then, I've avoided poo-pooing any recording medium as "not pro," because someone always manages to cut great tracks on the wildest machines. Michelle Shocked's premiere album was recorded live onto a Sony Walkman! And remember, the engineers who cut many of those classic tracks from the 1960s had less multitrack power to work with than today's ministudio owners. They did have, however, good ears, good mics, and creative vision. If you take the time to do things right—and manage to record a great song and a great performance—nothing can stop you from using a ministudio to produce a masterpiece.

EM *editor* **Michael Molenda** *began his engineering and production career on a Studiomaster 4-track ministudio. In the early 1980s, this British wonder machine had six full-featured input channels, 4-band EQ, and two aux sends per channel, and cost $2,200.*

Noise gates, such as Aphex's new Model 105, help sanitize ministudio tracks.

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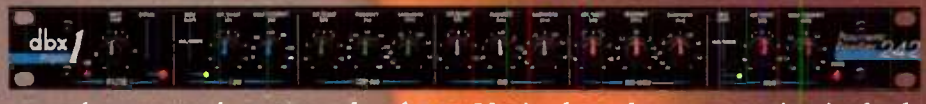

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User sampling is a godsend for one-shot sound events, ambient effects, repetitive vocal parts, and similar applications. In addition, the dance-music and rap scenes have spawned a tremendous demand for sampled percussion grooves and sounds lifted from classic albums. Audio CDs are a principle source of material for making music with samples.

ILLUSTRATION BY MARSHA STIEGER

FROM DISC

A lot of this material is original and of good quality. However, some companies sell samples of excerpts from copyrighted songs, and using these samples without the copyright-holder's permission is illegal.

Don't expect the CD manufacturer to look out for your interests; you must get legal clearance and pay royalties if you publish anything that uses these sounds. This is not a trivial matter, as copyright attorneys actively pursue artists who profit from pirated samples. (Obviously, if you don't sell your music or get airplay, nobody will know or care what you sample.)

Our goal is to work on better music production, not a criminal sentence for copyright infringement, so from here on, I'll focus on sampling instruments from audio CD. Besides, many of the principles are the same for sampling grooves.

DOING IT YOURSELF

Why not just sample everything yourself, from scratch? Because creating samples of acoustic musical instruments, for example, can be a real pain in the neck.

Let's say you want to create a bass clarinet disk for your sampler. First, you'll need to find a decent bass clarinetist and convince him or her to show up for a sampling session. (Many wind players consider samplers to be the devil's instrument.) Then, you'll need to explain what you want, get the performer to play note after note with perfect level and articulation, record the notes on tape, sample them, and map and loop each sample so it comes across naturally when played on a keyboard instrument.

No wonder most sampler owners prefer to buy ready-made disks of instrument samples. The work has already been done. All you have to do is plug them in and play. But even assuming that a sample disk of the instrument you want is available, buying dozens of prerecorded disks is often an extremely expensive way to acquire sounds for your sampler. If only it were possible to simplify the process of sampling acoustic instruments yourself....

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By Geary Yelton

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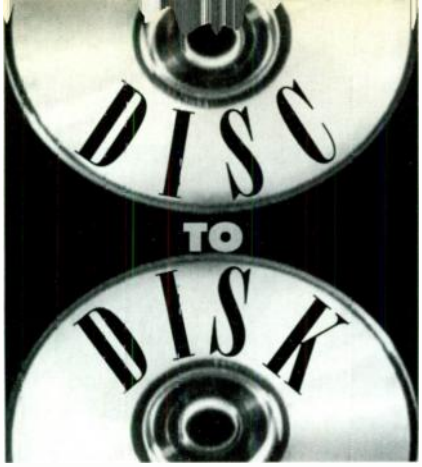


VOILA!

Your wish has been granted: If you sample from audio CDs, you skip a few steps and get right to the sampling, mapping, and looping. Sampling from audio sound-effects CDs has advantages, too. They offer a wide palette of unusual sounds that would be difficult to sample on your own. (Good luck trying to sample a train wreck in progress.) Sampling drum-machine grooves from audio CDs can save you a search for a classic beatbox and many hours of programming.

Don't confuse sample CDs with CD-ROMs. A sample CD is an audio disc that you can play on your CD player, exactly like all the other audio CDs in your record collection. A CD-ROM disc, which looks just like an audio compact disc, is a data-storage medium for a specific device, whether a Macintosh, IBM, Akai S1000, Roland S-760, or whatever. You could try playing a CD-ROM on your home CD player, but if it works at all, it's probably going to sound like unbearable noise.

A CD-ROM might contain sounds for your sampler, but only in that sampler's native format. (Fortunately, many samplers can import samples saved in multiple file formats.) Like those purchased on floppy disk, the instrumental sounds in a sampler's CD-ROM are usually normalized, looped, mapped out, and ready to play. When you sample instruments or effects from CD, however, you don't need to own a CD-ROM drive (or expensive CD-ROM discs). All you need is a CD player.

SAMPLE CD SOURCES

The sounds of one or several instruments may be found on a single sample CD, or they may be distributed on a series of discs. Some CDs contain examples of a single instrument played in several ways. A violin disc might have every note played legato, staccato, pizzicato, marcato, with and without vibrato, glissandi, behind the bridge, etc. Another disc may contain single hits from an extensive variety of percussion instruments. A sampler library disc may have an entire family of instruments in much less detail, or even a few selected sounds from every instrument in the orchestra. More often, sampler libraries are available on several CDs, arranged in volumes that can be purchased one at a time or all together.

Most sound-effects libraries are sold on compact disc. Even if manufacturers aren't aware that sampler users are buying their product, individual effects on disc are perfect fodder for sampling. They are usually arranged either alphabetically, or by category. Unlike instrumental sample CDs, sound effects CDs can be found in record stores.

▼

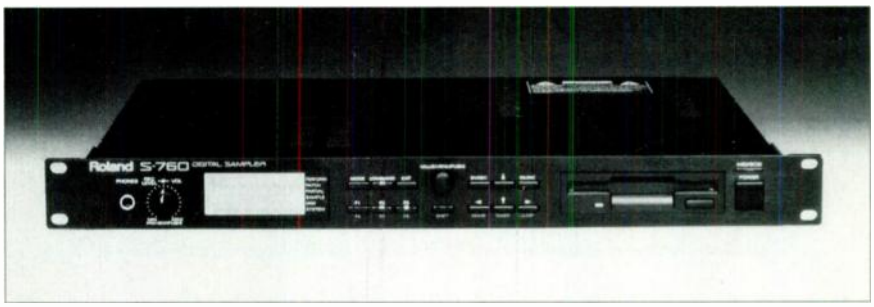
Copyright attorneys actively pursue artists who profit from pirated samples.

When buying sample CDs, it's good to know what to look for and what to *look out* for. It's essential that the samples are well documented, especially instrumental samples. A description of each sound should specify its location on the disc, pitch, relative velocity (hard, medium, or soft), relative depth of any effects, and if appropriate, its articulation (legato or staccato, with or without vibrato, etc.). Other details such as what kind of microphone was used or the brand name of the effects processor, though interesting, are nonessential information. In addition to listing track numbers, each individual sound should have an index number. If your CD player reads index numbers, it is easy to go directly to any sound on a CD.

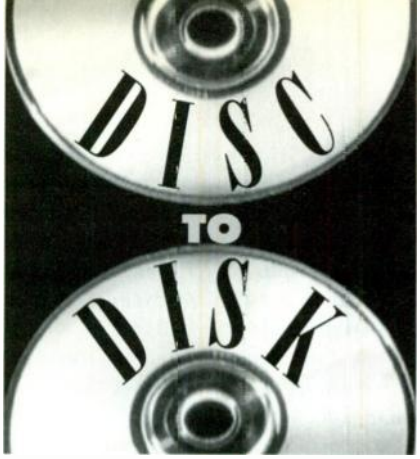
Avoid discs that try to cram too many instruments on one CD. A couple of years ago, I reviewed a CD with a number of programs from almost every synthesizer on the planet. What a deal, I thought; all those synthesizer sounds for the cost of a single CD. The trouble was that there were no more than one or two notes per octave, making it necessary to stretch each note to the breaking point when multisampling. As a result, the CD was useless.

Even with plenty of notes, it's often impossible to judge the quality of a sample CD until you actually try to sample from it. If there's anything uneven about the sounds from one note to another, you'll notice the differences when you multisample it and play up and down the keyboard. Some notes may have been played more aggressively than others. Some may have much more vibrato than others. Worst of all, some may have just a bit of pitch bend in their attacks. Any inconsistency makes certain notes stick out like sore thumbs, and no amount of processing can fix them.

The better-known companies that market made-for-sampler compact discs include East-West, Big Fish Audio, InVision, Sound Ideas, Hollywood Edge, and a handful of others (for a more thorough list, see sidebar "Sample CD Sampler"). Most are sold through mail order, though you can occasionally find and audition sample CDs in music stores. Some sample CD makers offer demonstration discs of music created with their samples. (This week, I'm listening to InVision's excellent demo



The Roland S-760 sampler is available with optional S/PDIF digital I/O, a format found on many CD players. This lets you sample CD audio in the digital domain.



disc of music played with samples by Miroslav Vitous.)

Ensoniq's ASR-10 can address up to 16 MB of dynamic RAM, a big improvement over the EPS-16 Plus. The latter could only be expanded to 2 MB of DRAM, not enough for serious CD sampling.

SAMPLING AND EDITING

No matter how good the sounds are on disc, they are only raw material. The ultimate quality of the samples being played by your sampler is determined by how well you sample and edit them. Let's examine the process of turning the individual notes on a piano CD into a usable disk.

The first step is to get the sounds into your sampler. When sampling from CD, you're faced with many of the same questions as any instrumental sampling session. Before you begin, you need to plan. What's your sampler's maximum sampling time? Do you want the piano samples to take up all its memory, or should you save room for other instruments? Should you cut the sampling rate to increase the available sampling time? Some sample CDs offer every note played both hard and soft. Do you have enough memory to record both versions and then velocity switch or crossfade between them? Should you record every note, every minor third, or every octave?

Only you can answer these questions, based on your needs and preferences, but there are some general guidelines. Depending on the environment in which it's going to be played, you may want to use a lower sampling rate to conserve memory. If you're playing in a noisy rock 'n' roll bar through a cheap P.A. system, sampling at 44.1 kHz doesn't make a lot of sense. When you're going to all the trouble of creating banks for your sampler, though, you want the highest quality you can muster. Also, because CDs are recorded at 44.1 kHz, there's no need to use a higher sampling rate.

As to whether you should record every note, the answer is usually "no." Most instruments will let you record every minor third, and some let you get away with as much as a perfect fifth before munchkinization sets in. There's always a tradeoff between audio quality and memory limitations.

For piano, I find that recording a note every major third works well. It can be transposed up a half step and down a whole step with no ill effects. Keep in mind that it's easier to sample lower pitches at wider intervals than higher ones. The interval you choose also depends on your sampling source: If the CD offers only three pitches per octave, you obviously can't record them every major third.

The question of recording at both hard and soft velocities also depends on the instrument. Pianos and other instruments whose harmonic content varies greatly at different velocities should, whenever possible, be sampled both ways. A piano sampled at a medium velocity doesn't sound natural when you bang it hard or tickle it quietly.

Until unlimited memory is available, compromises must be made. The solution may be to record at slightly harder-than-medium velocity and control the filter cutoff frequency with keyboard velocity. If the CD from which you're recording doesn't have a harder-than-medium version, you should probably stick with the hard version and use filtering as necessary. If you're a lounge pianist in a swanky restaurant, though, the soft version may be perfectly sufficient.

As with any sampling session, recording at the right level is crucial. If the level is too low, there's going to be too much noise in your recording. If the level is too high, digital distortion will rear its ugly head. Go for the maximum level without clipping for the best signal-to-noise ratio.

Whether you manually trigger sampling or wait until a signal threshold is detected depends on the sound. Even sounds you don't normally think of as harmonically rich may have complex attack transients that are lost if you let sampling begin automatically. It's usually better to trigger recording yourself and then truncate any silence at

Akai's CD3000 sampler lets you import digital audio directly from CD and offers the same editing capabilities as Akai's powerful S3000 sampler.

the beginning of the sample. This is more time-consuming, but the results are usually more satisfactory. Some percussive sounds, however, lose their punch if their peak attack comes too many milliseconds after they're played.

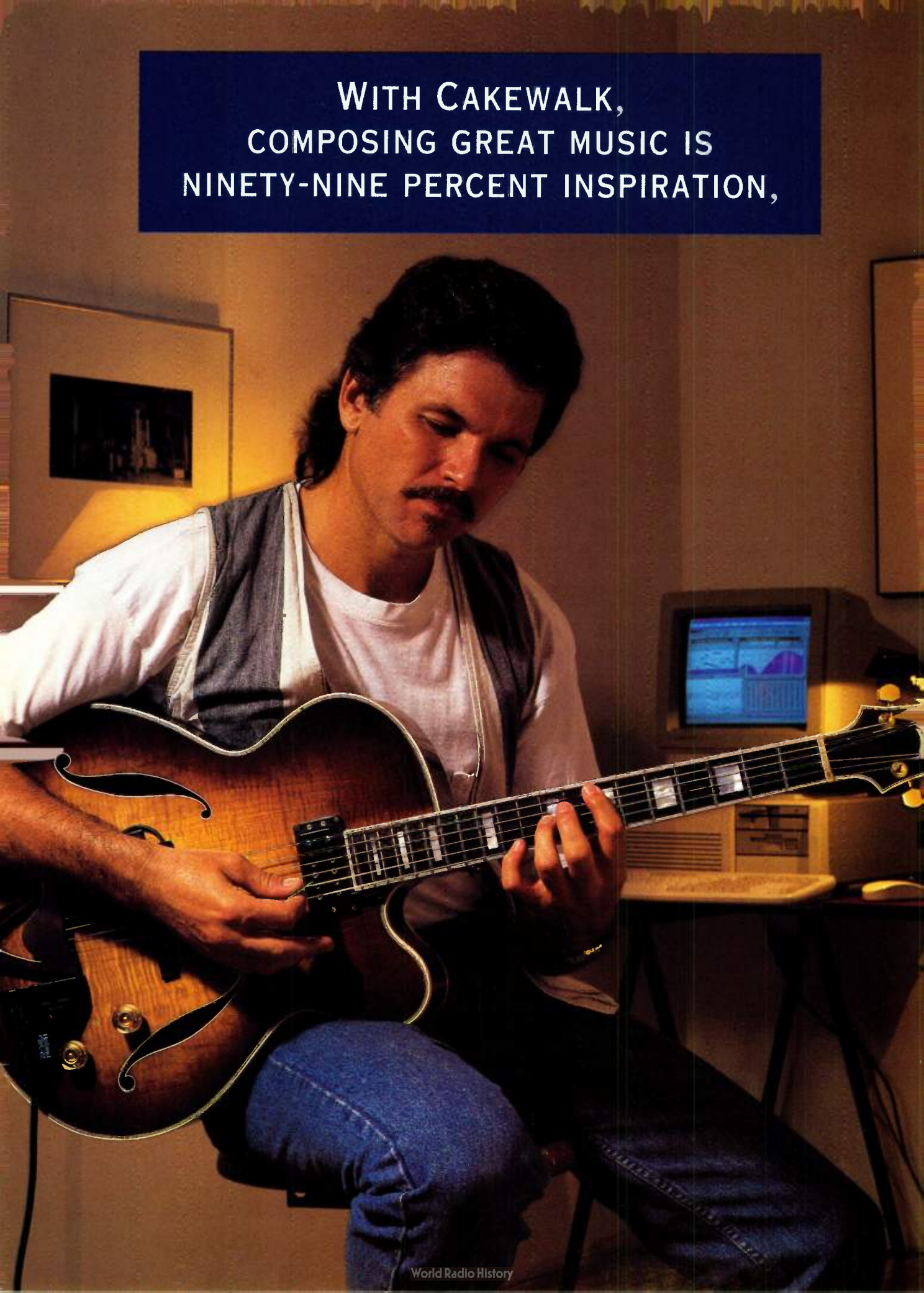
How long should each sample be? Just like sampling live instruments yourself, they should be as short as possible without compromising quality. You can always loop instrumental sounds to make them sustain longer than the length of the sample. Most instrumental samples on CD are longer than any sampler can handle, so it's necessary to record only a portion and loop the rest. You can get away with shorter sampling times when recording brass and reeds than you can with sounds whose spectrum changes over time, such as piano, strings, and voices. To make matters worse, complex sounds are also the most difficult to loop.

▼

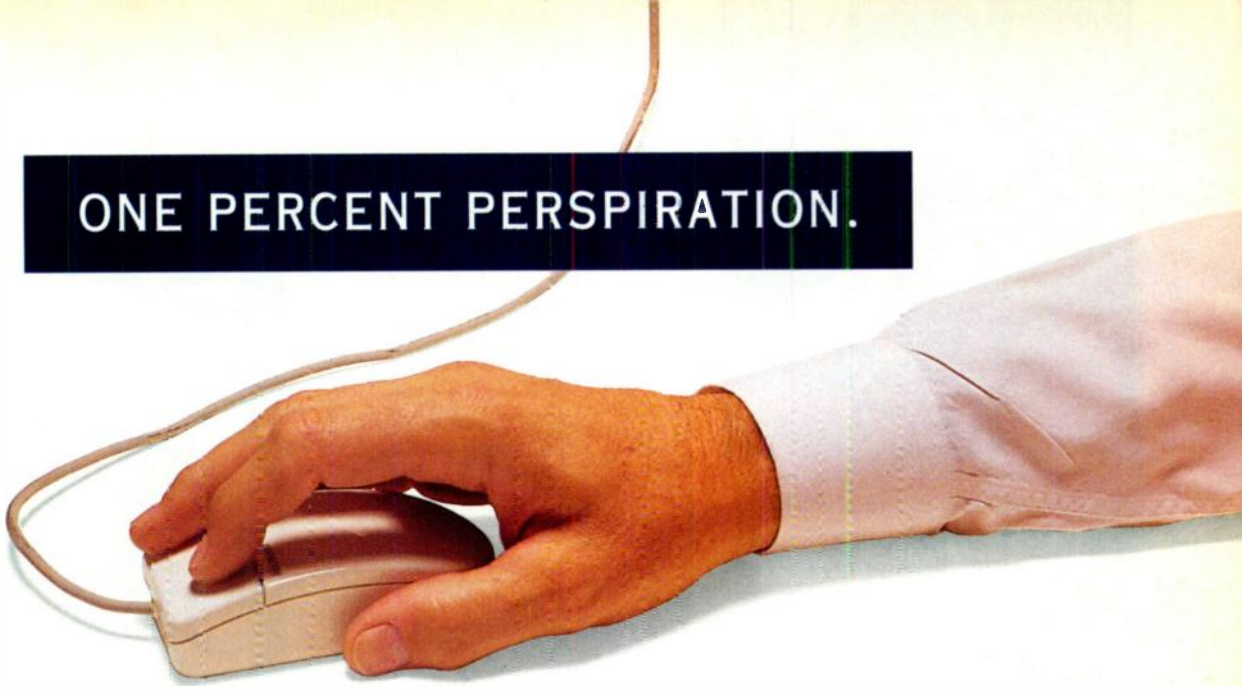
By sampling from audio CDs, you skip a few steps and get right to the sampling, mapping, and looping.

Whenever possible, the solution may be to record samples with vibrato. That way, loop points are easier to find, because vibrato is a periodic, repeating articulation. Most players would rather record samples without vibrato and add vibrato with their modulation wheels or Aftertouch. Vibrato from a modulation source periodically changes pitch, and sometimes the filter cutoff. With harmonically complex sounds, though, changes in amplitude, spectrum, and pitch are not as periodic as you might expect. You can still use a modulation source to make sampled natural vibrato faster or more complex.

On the other hand, vibrato makes it necessary to multisample at closer intervals. When you transpose a sample up or down, the vibrato rate increases or decreases, making the vibrato much less natural-sounding. The ultimate



ONE PERCENT PERSPIRATION.



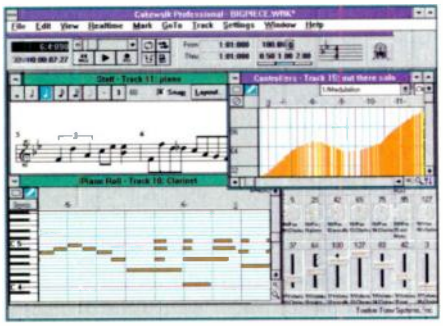
Cakewalk Professional for Windows™ 2.0 is the MIDI sequencer that's powerful enough to transform your inspirations into compositions. Yet it's no sweat to use.

MAKE A NOTATION OF THIS.

Cakewalk Professional works in concert with you every step of the way. In fact, new version 2.0 not only helps you create your compositions, it also prints them. The multi-track Staff view lets you edit and print up to 16 staves in multiple key signatures, as well as title, performance instructions, author and copyright information. It even displays and prints triplets. All in the font size you select.

YOU'LL LOVE THE VIEWS.

With Cakewalk Professional, composing music is an aural and visual experience. You can use the Piano



Roll view to insert, resize and move notes in a grid. The detailed Event List view lets you edit MIDI and multimedia events on multiple tracks at once. Use the Track/Measure view to assign track parameters like MIDI channels, instrument patches and key offsets, even in real-time.

Cakewalk PROFESSIONAL for Windows

Other extraordinary Cakewalk Professional features include a Controllers view, a variable timebase of up to 480 pulses per quarter note, a Markers view for creating text "hit points," an Event Filter and on-line help screens.

NEW WAYS TO COMPOSE YOURSELF.

Cakewalk Professional 2.0 offers other new features like:

- Play List view for live performance
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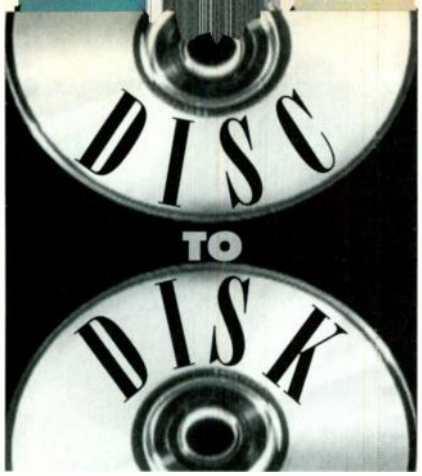
- Real-time editing
- Remote control from MIDI keyboard
- "Hot Key" macros
- Loop record
- Punch record on the fly
- Big Time display

INSPIRED YET?

If you feel inspired to find out more about Cakewalk Professional for Windows 2.0, or to learn the name of the dealer nearest you, give us a call at **800-234-1171** or **617-926-2480.** Cakewalk Professional lists for just $349. If you'd like, we'll send you a demo disk for just $5 so you can see and hear Cakewalk Professional for yourself.

Twelve Tone SYSTEMS
P.O. Box 760, Watertown, MA 02272

System Requirements: IBM PC with 10 MHz 80286 or higher, 2 MB of RAM, mouse; Microsoft Windows 3.1. Supports any combination of up to 16 MIDI ports on devices with Multimedia Extensions drivers (including Roland MPU-401 compatibles and Music Quest MQX interfaces). Cakewalk Professional for Windows is a tracemark of Twelve Tone Systems. Other products mentioned are trademarks of their respective owners.



output level on the CD player, or the input level on the sampler, saving another step in the sampling process.

Also consider a portable CD player. They're convenient and can sit beside your sampler, putting the controls for both within easy reach. These tiny devices are handy for carrying to sampling sessions outside of your studio. Good portable CD players offer the same features found on full-size CD players.

CHOOSING A SAMPLER

If you're in the market for a sampler, get one that can accommodate lots of onboard memory. In these days of 44.1 and 48 kHz sampling rates, 2 MB doesn't go very far. Even with 16 MB of RAM, maximum sampling time in stereo at 44.1 kHz is around 90 seconds. That may sound like a lot to veteran sampler jockeys, but it's going to be a limitation in the future.

If the sampler doesn't have a digital-audio port, check to see whether one can be installed as an option. Also be sure to check what type of port is available; an S/PDIF port on your CD player is only useful if there's an S/PDIF port on your sampler.

The best of both worlds would be a sampler with a CD player built in. Such a beast exists, and it's called the Akai CD3000. Though it's also a CD-ROM player, the CD mechanism in the CD3000 allows you to sample from audio CDs. Everything stays digital without the need for an external audio input. Best of all, a single user interface makes sampling from CDs as painless as possible.

COST VS. CONVENIENCE

In the end, the best reason for sampling from CDs comes down to saving money. Sampling from CDs take time, it's true, but not as much as sampling live audio sources from scratch.

Think of sampling sources as a hierarchy of cost that's inversely proportional to convenience. Like many things in life, the more accessible they are, the greater the expense. A sampler library on floppy disk is the handiest, but the most costly way to buy samples. CD-ROMs are less expensive than floppies, but considerably more than audio CDs. Often the same sample libraries you can buy on CD-ROM are also available on audio CD.

If you consider that sampling instruments yourself requires at least a good microphone, a studio environment, and some decent players, samples on audio CDs may be the greatest bargain of all.

The author's grandmother was named "Media," but it was pronounced the same as MIDI. His first name is Geary, so what does he write about? MIDI gear, of course.

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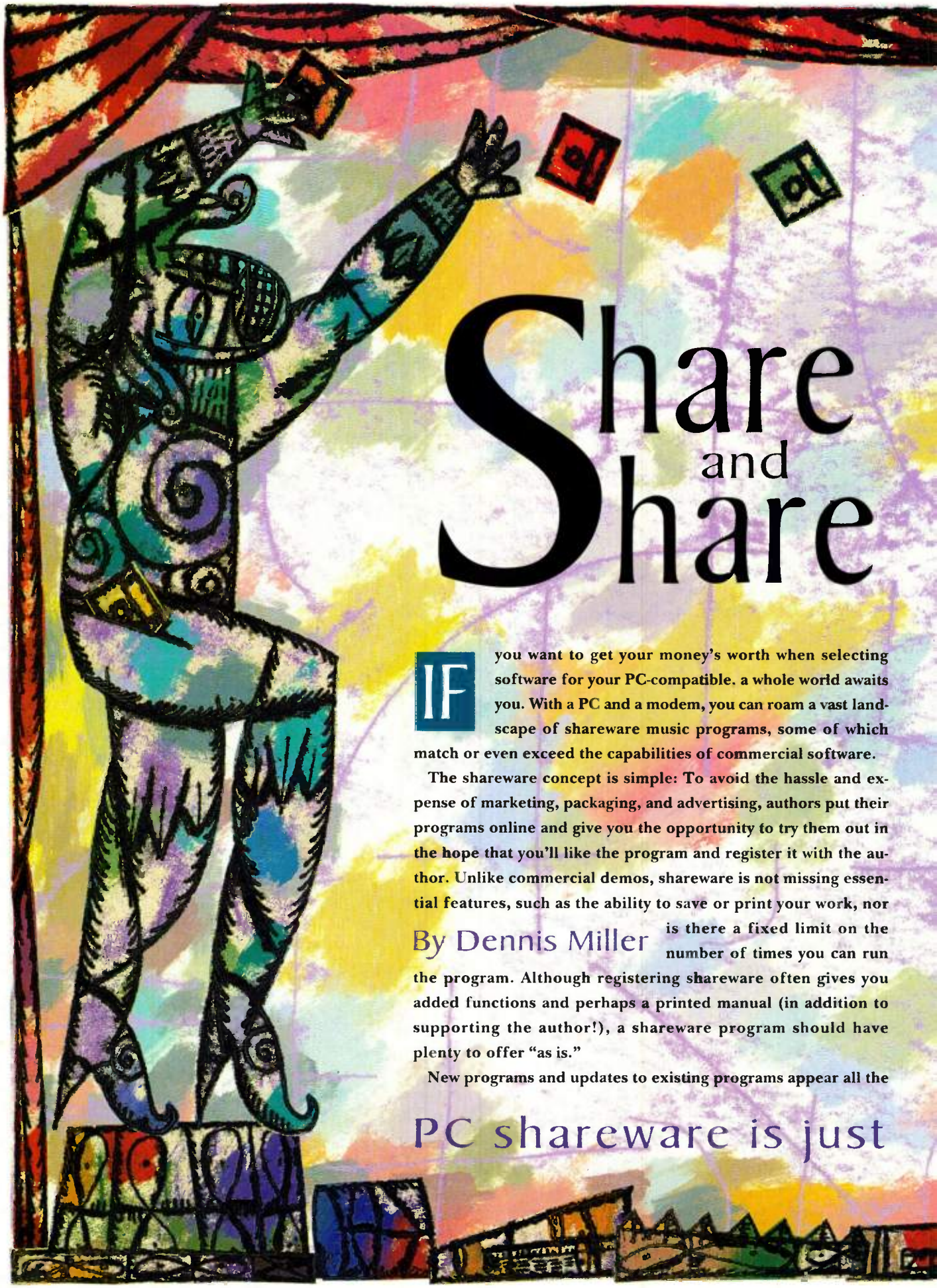
ALESIS STUDIO ELECTRONICS



Share and Share

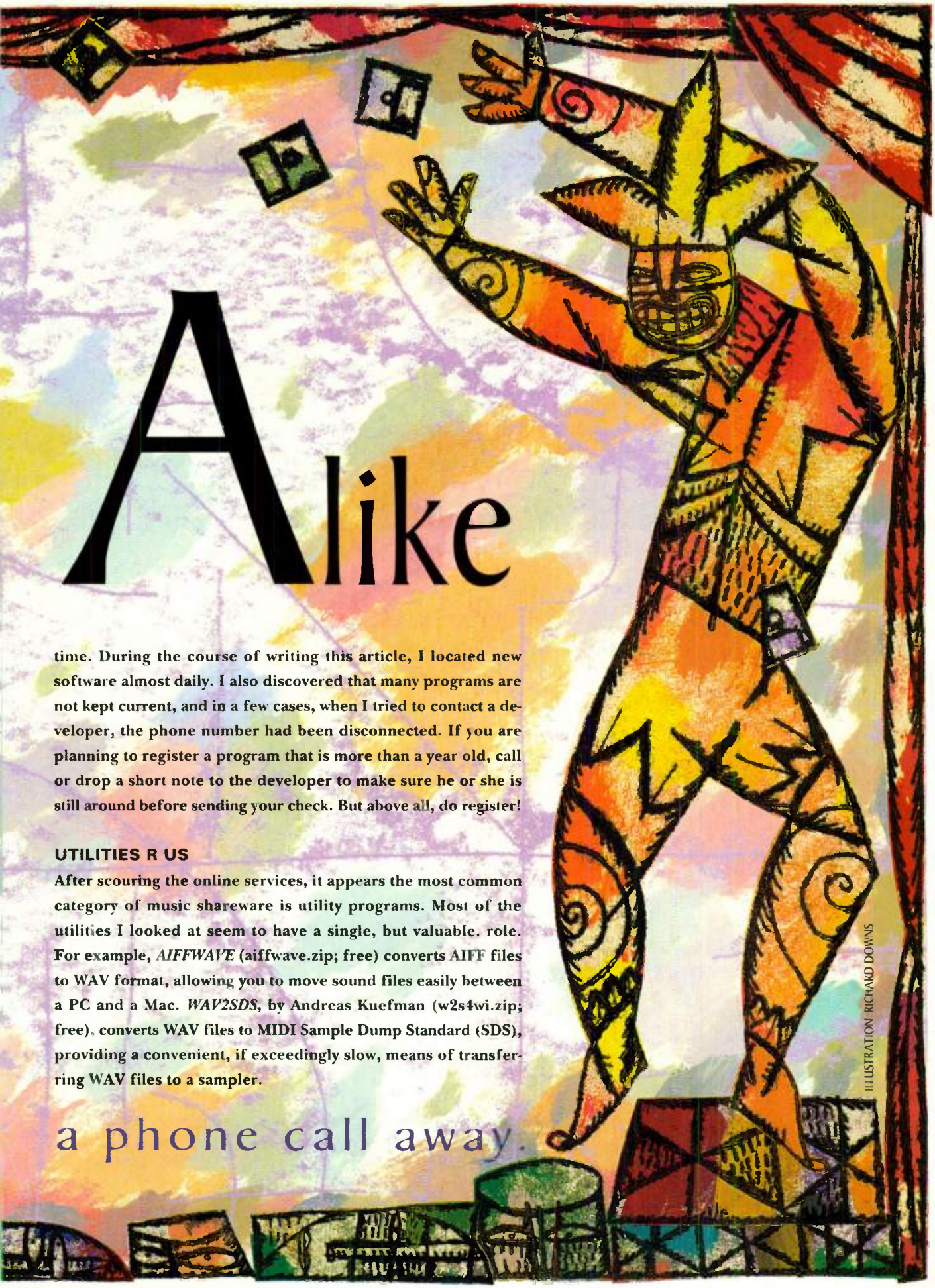
IF you want to get your money's worth when selecting software for your PC-compatible, a whole world awaits you. With a PC and a modem, you can roam a vast landscape of shareware music programs, some of which match or even exceed the capabilities of commercial software.

The shareware concept is simple: To avoid the hassle and expense of marketing, packaging, and advertising, authors put their programs online and give you the opportunity to try them out in the hope that you'll like the program and register it with the author. Unlike commercial demos, shareware is not missing essential features, such as the ability to save or print your work, nor is there a fixed limit on the number of times you can run the program. Although registering shareware often gives you added functions and perhaps a printed manual (in addition to supporting the author!), a shareware program should have plenty to offer "as is."

By Dennis Miller

New programs and updates to existing programs appear all the

PC shareware is just



Alike

time. During the course of writing this article, I located new software almost daily. I also discovered that many programs are not kept current, and in a few cases, when I tried to contact a developer, the phone number had been disconnected. If you are planning to register a program that is more than a year old, call or drop a short note to the developer to make sure he or she is still around before sending your check. But above all, do register!

UTILITIES R US

After scouring the online services, it appears the most common category of music shareware is utility programs. Most of the utilities I looked at seem to have a single, but valuable. role. For example, *AIFFWAVE* (aiffwave.zip; free) converts AIFF files to WAV format, allowing you to move sound files easily between a PC and a Mac. *WAV2SDS*, by Andreas Kuefman (w2s4wi.zip; free), converts WAV files to MIDI Sample Dump Standard (SDS), providing a convenient, if exceedingly slow, means of transferring WAV files to a sampler.

a phone call away.

ILLUSTRATION RICHARD DOWNS

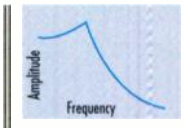
The Future. Plane and Simple.

Does the world of electronic musical instruments seem like it's stuck in an endless rut? New bells. New whistles. Same old sound...

Well, if so, take E-mu's new Morpheus™ Z-Plane™ Synthesizer for a test drive. Sure, it's got bells and whistles in abundance. But it's got something else that sets it apart from the digital crowd: new sounds and expressive control that you've never experienced in a MIDI instrument.

At the heart of Morpheus is E-mu's new Z-Plane Synthesis technology. Unlike the simple 2-or 4-pole filters of traditional synthesizers, Morpheus' 14-pole Z-Plane filters are capable of modeling virtually any resonant characteristics and then interpolating (or "morphing") between them in real time.

Imagine sending a saxophone through the body of a violin and then smoothly morphing it into a distortion guitar. Or send a piano through the resonances of the human vocal tract pronouncing a variety of vowels. Or sweep a synth pad with 32 polyphonic flangers. Or use a mod wheel to control the subtle timbral changes that result from picking an acoustic guitar at different distances from the bridge. These are just hints of what Morpheus is all about.



Traditional Synthesis

Single, 4-pole lowpass filter with resonance.

Z-Plane Synthesis

Allows you to "morph" sounds through multi-dimensional, 14-pole filters.

And remember those bells and whistles? Morpheus gives you everything you need to harness its Z-Plane filters. Like a seriously enhanced version of our powerful MIDIPatch™ Modulation System. Like multi-segment function generators for microscopic sound-sculpting. Like a new Hyper-Preset mode that lets you split, layer and cross-switch between 16 presets at once—for sounds so thick you can swim in them.

And since Morpheus is from E-mu, all this power comes wrapped in the industry's clearest, most straightforward user interface. Add 32-voice polyphony, 16 part multi-timbral operation and dual stereo effects processors, and you've got the synthesizer to move your music into the next century.

Best of all, you won't have to wait for the next century. Check Morpheus out today at your local E-mu dealer. Where the future is now.

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Richard Goodwin's *WAV-to* lets you transfer WAV files to the Yamaha SY85 (wave2.zip; £20, British), while Jeff Cazel's *Canvas Man* (Canvas.zip; $59) is an elaborate patch editor that is a must-have for owners of the Roland Sound Canvas.

SysEx loaders make up another fairly large group, and *MIDIEX* (MX- 1A1.zip; free) by Tom Cohoe, seems the most popular. I found *MIDIEX* really handy when I bought a used Alesis HR-16 drum machine that had lost all its pattern memory. In a panic, I downloaded the factory defaults from CompuServe and reloaded them into the machine with *MIDIEX*. In no time, I was back in business.

If you think it would be fun to build your own patch editor, you could spend a year learning everything there is to know about SysEx messages, or simply download a copy of *WinSysEx* (WSYSEX.exe; $39), written by Don Strenczewilk. *WinSysEx* provides you with the tools needed to construct your own editor, such as ready-made sliders, buttons, and more. It also includes model editors for several popular synths to help you through the process.

Speaking of sliders, you'll find lots of them in *MIDIBARS* (MIDIB1.zip; $25), by Richard Huntrods. Although it's becoming more common for commercial sequencers to include configurable faders, *MIDIBARS* gives you an entire screenful of sliders that can generate continuous controller or other data. The program also provides a small keyboard display to trigger Note-On messages on assignable channels. Unfortunately, the faders in the current release are not recordable, so you can't use them to do multichannel, automated fades or pans.

The top prize in the Utilities category goes to Thierry Tabard for his *MIDIMUX* (midkbd10.zip; free), a "virtual" *Windows* MIDI driver that allows you to send data from one MIDI application directly into another while running in Enhanced mode. Simply place the *MIDIMUX* driver file in your /Windows/System directory and add a line to your system.ini file, and *MIDIMUX* will appear on the Drivers list in your Control Panel. Then, in the MIDI Setup section of your application, choose *MIDIMUX* for the program's output. Select *MIDIMUX* as the record input in the program that you want to receive the data, and you're all set. (Be sure to set the receiving program to external sync, so it won't start recording before the data gets there.)

Using *MIDIMUX*, I had no trouble getting *Master Tracks Pro* to send its output to *Encore* in real time. This kind of communication between applications has never been generally available on the PC before, though some developers, such as Spectral Synthesis and Big Noise Software, allow communication among their own suite of programs. (Digidesign's Session 8 for the PC also allows a sequencer to drive its MIDI functions in real time.)

Finally, for a laugh, get *ASCIIMID* (ascmid.zip; free), a program by Randy Stack that will convert any text or executable file into a Standard MIDI File. See what happens when you turn the lyrics to your latest song into MIDI Note-On messages! The program simply maps ASCII values between 32 and 128 to note numbers 0 to 96 and values outside that range to rests. (Velocity values are randomly generated.) Let me know if you get some good results.

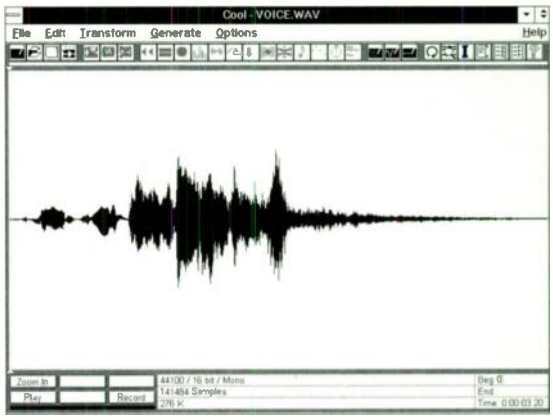

FIG. 1: Slick, well integrated, and full featured, *Cool Editor* has functions that equal or exceed those found in many commercial programs and costs just $10!

WAVE EDITORS

One of the fastest growing categories of software for the PC is the waveform editor. Because most sound cards come with only limited editors, a booming market exists for products that extend the functionality of your sound card. In this category perhaps more than any other, I found programs that matched and even exceeded the features of commercial programs.

My prize for the best shareware wave editor goes to *Cool Editor* (cool131.zip; $10), by David Johnston. Despite its retro name, *Cool* is slick, well integrated, and full featured. *Cool* is more than just a wave editor, though, as it integrates a basic synthesis engine for creating and modulating waveforms. In addition, *Cool* 's Music Generator option allows you to alter wave files in some unusual ways.

Cool's main screen displays the familiar amplitude-versus-time waveform graph (see **Fig. 1**). Icons for the program's main functions are shown at the top of the screen, and complete online help is available for all areas of the program. Help "balloons" also appear as you click over the various icons, giving you a visual reminder of each icon's purpose. Like other well-designed *Windows* software, numerous aspects of the program can be configured and stored as default settings.

In addition to a host of cut, copy, and paste options, *Cool* provides a very

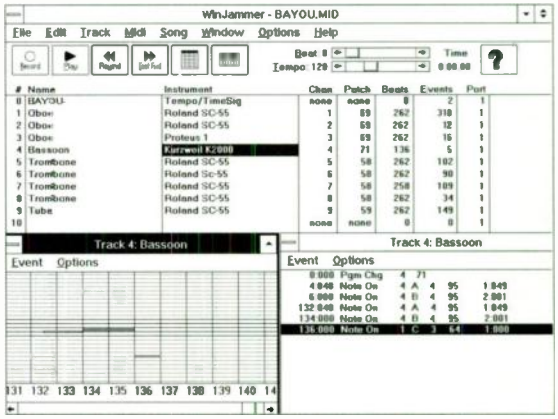

FIG. 2: *WinJammer* is an excellent 64-track sequencer. Its $50 registration fee can be fully credited toward *WinJammer Professional*, a commercial program.

fancy toolkit of processing functions, including echo, flange, stretch (with or without pitch shift), and delay. There's also a Tone Generation tool for creating various time-varying waveforms and filtered noise. Choose one of the nine wave types, assign it a fundamental frequency and duration, then set the start and end amplitudes for each of up to four harmonic partials. You can scale the fundamental's pitch using a single stage, linear envelope, or modulate the waveform using independent LFO frequency and depth controls. Separate left and right channel faders are also available to control amplitude.

Cool adds other features that I haven't seen in any commercial wave editor. One of these is a sophisticated scripting language that allows you to create long, complex macros. For example, if you typically need to normalize a file after recording it, you can generate a script to "replay" the entire normalization process. Several example scripts are included for study.

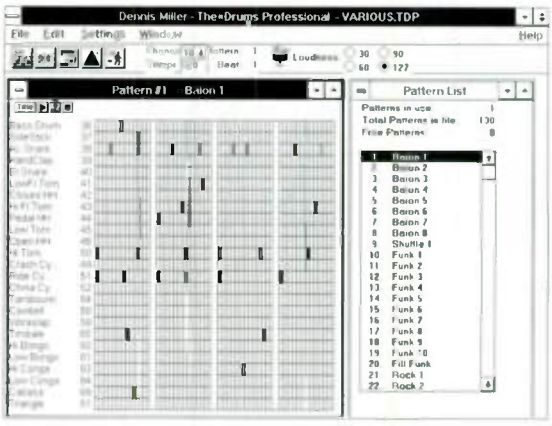

FIG. 3: The *Drums Professional* is a sophisticated drum-pattern sequencer that includes a General MIDI drum kit and templates for numerous popular drum machines and synths.

A second unique feature is the Music Generation function, where you compose a melody using standard notation that will serve as the scaling function for pitch transpositions of your sample. For example, I loaded a sample of my car's horn, notated "Happy Birthday" in the Music Generator, and then

SHAREWARE SOURCES

Major sources for music shareware include commercial services, such as CompuServe and America Online; privately owned bulletin boards; and the most massive and mysterious of all, the Internet. The largest public online service, CompuServe has a MIDI Forum with thousands of current members and offers a huge range of music programs in the forum's MS-DOS and *Windows* Media libraries. The Forum has sections dedicated to different categories of hardware and is a great place to ask questions and get help. Here's a tip: If you can't find a program under the name shown here, use the File Finder to help you search. To initiate the search, type **GO IBMFF** and follow the instructions. Unfortunately, there's no easy way to search by program author, but with a little luck, you should find everything you're after.

Another way to get files is to subscribe to a local service such as Channel One (tel. [617] 354-7077) in Cambridge, Massachusetts. Channel One has hundreds of music programs, not to mention a massive number of MIDI and WAV files. One-time annual subscription rates are based on download time; for example, 45 minutes per day, regardless of baud rate, will cost you $70 (with a 600-file download limit). Because there's no added connect charge, I find Channel One far more cost effective than CompuServe for retrieving files.

One of many private boards dedicated to MIDI and music is MIDImaze, based in Manchester, Tennessee (tel. [615] 723-1867). Among its other services, MIDImaze sells CD-ROMs containing hundreds of music programs and files. Subscription rates for are competitive (60 minutes per day for one year is $55), though you can get limited privileges for nothing. You'll find numerous other MIDI BBSs listed in a file called MIDI0992.zip, available almost everywhere.

To get files off the Internet, you need an account through a college or university, or you can join via a dial-up provider such as Delphi (tel. [800] 695-4005), or The World (tel. [617] 739-0202). There are hundreds of sites where music files are stored, although I've never located a definitive list. (For a detailed look at the Internet, see "Cruising the Internet" in the April 1994 **EM**.)

One site worth noting is the International Computer Music Association's new library at Dartmouth.edu in the pub/ICMA-Library. Here you'll find text files describing software that ICMA members are making available for distribution. (The software itself is available elsewhere.) The ICMA library is small at present, but should become a major source of information soon. Two other popular spots to keep an eye on are louie.udel.edu, especially the pub/midi/software/ibm directory, and garbo.uwasa.fi, in the /windows/sound directory. As is the custom, access the sites via ftp, log on as "anonymous," and use your e-mail address as your password.

Keep in mind that even without a modem, you can get many shareware programs on disk. Two of the largest distributors that provide this service are Public Brand Software (tel. [800] 426-3475), and Public Software Library (tel. [800] 242-4775). Both have extensive music offerings.

If you plan to do a lot of downloading, you will appreciate having *Winzip* (Winzip5a.zip) on hand. *Winzip* is a fantastic shell for extracting and compressing files and has dozens of useful features. And finally, downloading files can be hazardous to your computer's health, so be sure to practice safe computing. Use a virus checker such as McAfee's *Scan* (scan109.zip) to ward off potential disaster.

Vision 2.0

Critics Rave...

Electronic Musician

"Vision 2.0 offers a unique combination of power and ease of use. There's simplicity for the user who wants to get to work immediately, along with the depth that a power user craves.... This package will be hard to beat. Those of you looking for a professional sequencer, or even those who are already using another one, owe it to yourselves to give it a test run.... When I began working with Vision 2.0 I carried with me eight years of experience with another sequencer.... Given that starting point, I'll have to admit that I (and more than a few of my musical friends) am startled at the outcome: I've decided to switch to Vision...." *—Dan Phillips, May 1994 issue*

Keyboards Recording & Computers -Germany

"Users with professional expectations will find that Vision 2.0 will do almost everything that one can wish for. This sequencer, with the multitude of functions and operations does not have to hide behind the competition's products. I don't want to exaggerate, but in my opinion the term 'unbelievable' is actually too tame a word to describe the capabilities of Vision 2.0." *—Ralf Kleinermanns, March 1994 issue*

Sound On Sound -UK

"Vision is one of the most well-behaved, and 'bullet-proof' pieces of MIDI software available for the Macintosh, and sets a standard which others will now find very hard to beat. All-in-all, Vision 2.0 was a joy to use, and I was able to set up the tracks to communicate effectively with my MIDI rig much more easily than with any other Mac sequencer. If I had to choose just one MIDI sequencer to be marooned with on a 'desert island' it would now almost certainly have to be Vision 2.0!" *—Mike Collins, June 1994 issue*

Keyboard Magazine

"Vision 2.0 has just been released. Given that this is the first time in four years that Opcode has seen fit to increment the 'ones' column, you've got to imagine that this is one serious upgrade. It most certainly is.... Vision 2.0 sports a streamlined, intuitive interface, a clean look, and simple, straight-ahead operation—without sacrificing power.... It is far easier to learn, far easier to understand, and far easier to look at than earlier versions. Of even more importance: the program is much more powerful than before, partly due to the addition of new functions, but primarily because the existing functions are now far more accessible and intuitive.... Our final verdict? If we had three thumbs, they'd all be pointing up." *—Michael Marans, March 1994 issue*

Vision for Macintosh, the professionals' choice in sequencing.

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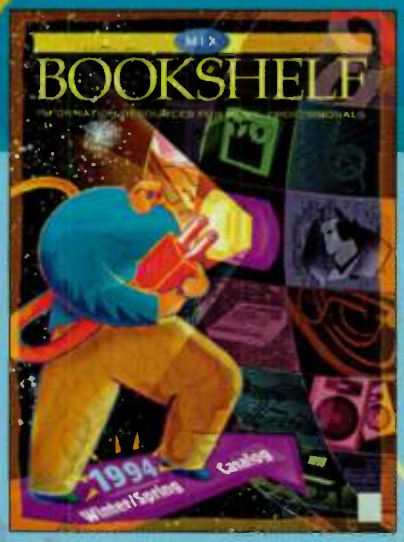

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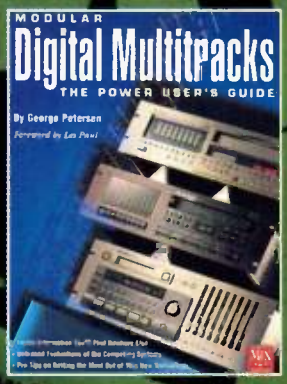

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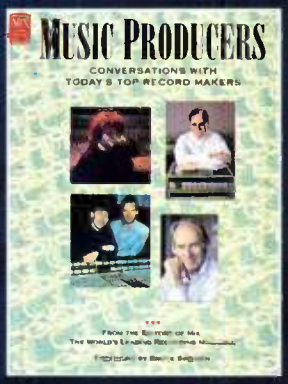
If you've got one of the new modular digital recorders or have ever thought about buying one, you need this book. Petersen explores these revolutionary machines, tells you how they work and shows you how to operate them. Inside, you'll find unbiased evaluations of the five units and various peripherals, inside tips on connecting and operating these systems, advanced techniques for synchronization, editing and mixing, features that aren't mentioned in the manufacturers' literature, and secret commands and undocumented error messages. And the book pays for itself, with manufacturer rebate cards for cash discounts when purchasing your own digital multitrack gear and instructions on making your own cables and snakes!



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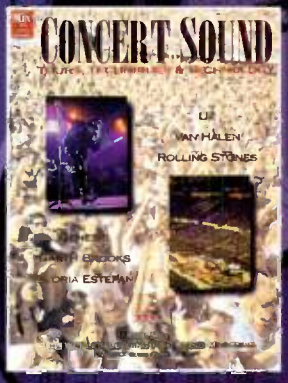

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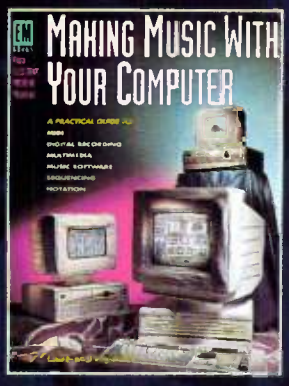

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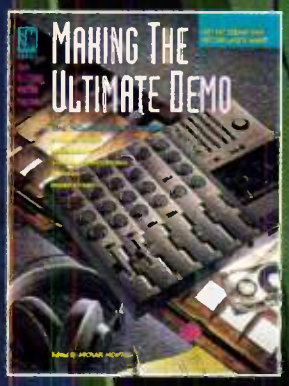

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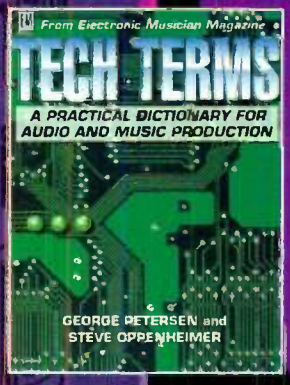

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Explains 300 of the most commonly misunderstood words and phrases in the field of studio recording, digital audio and electronic music. Keep this handy guide near your mixing console or musical instrument for precise, plain-English definitions of MIDI terminology, synth and sampler jargon, computer buzzwords and audio abbreviations. Written by the senior editors of *Mix* and *Electronic Musician* magazines.

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applied the pitch contour of the song to the sample. Although you probably won't use it to score your next film, the Music Generator is a lot of fun, and offers tempo control; a small, but functional, range of notation symbols (including accidentals and rests); and the ability to preview your tune via MIDI output.

Cool Editor has many other features, such as multisegment filter envelopes that morph between settings and versatile play and cue lists. Overall, it's one fancy program and should be checked out by anyone doing desktop audio.

If you need something more basic, try out *NoiseMaster* (NM201.zip; $25, payable in Dutch guilders), by Alwin Hoogerdijk. *NoiseMaster* is a simple but elegant wave editor that allows you to record and play files at sample rates of up to 44.1 kHz stereo. There are several cut and paste options; a modest, but functional suite of effects; and my favorite feature: a scroll bar used to change a file's sample rate while it plays back. The program supports both WAV and VOC files.

You might also consider *WaveS* (WAVS16.zip; $29.95), a prize-winning editor by Brian Gunnison. *WaveS* has numerous processing functions, offers several different views of waveform data, and allows easy cutting and pasting among different files. A Cutting Room Floor feature can be used for quickly building long waveforms by automatically appending segments of different files to an existing file, while a Wave Create option generates fixed waveforms of any length.

If you're not hooked on working under *Windows*, *Blaster Master* (bmstr595.zip; $29, or $49 for deluxe registration with extra features), by Gary Maddox, is an excellent, DOS-based wave editor. Though not as comprehensive as *Cool, Blast Master* provides precise editing control of audio files under an attractive graphic interface and offers an extensive toolkit of processes. Its support for numerous file formats—including VOC, WAV, Amiga IFF (import only), and SND—make it a good choice for desktop work. The deluxe registration gets you 64-band equalization and a utility to play CD-audio on a Creative Labs MultiMedia CD-ROM.

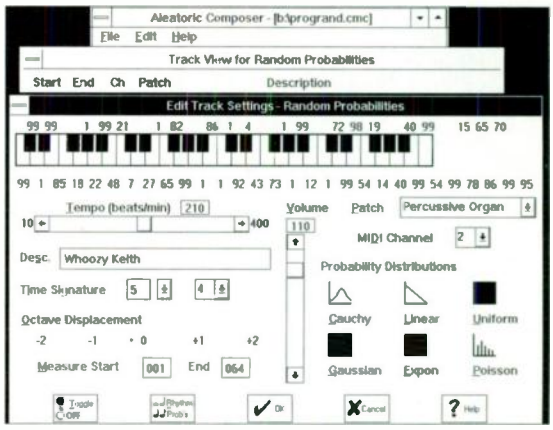

FIG. 5: *Aleatoric Composer* is an algorithmic composition program that uses graphic screens for the selection of random possibilities.

SEQUENCERS

Several well-designed sequencers are available as shareware, but nothing I found will knock the top commercial programs off the charts. Easily the best of the bunch I looked at is *WinJammer*, by Dan Mckee (wjmr23.zip; $50, with full credit for an upgrade to *WinJammer Professional*, a commercial program), which has just been released in version 2.3. The previous version holds the distinction of having been downloaded over 3,100 times on CompuServe alone!

WinJammer is an attractive, 64-track sequencer that provides easy movement among its track list, piano-roll, and event-list work areas (see **Fig. 2**). There's extensive SysEx support: You can import files in *MIDIEX* format, send and receive SysEx data right along with other data types in a track, or build your own SysEx commands using a modest editor. Among the editing features, Track Transform is especially handy: Use it to adjust, set, or remap the values of different types of events in a track. Track Split allows you to break out a track by channel, event type, individual notes (good for drum tracks), or key range.

WinJammer supports AdLib files and can be configured to remap patch values automatically upon import. It also comes bundled with a stand-alone MIDI file player that can be used to create extensive song lists, complete with programmed delay between songs.

For sophisticated drum-pattern creation, try Fabio Marzocca's *The Drums Professional* (tdp110.zip; $50, applicable toward the purchase of *Rhythm Brainz*, by Media Tech.) Using a grid of either three or four measures, with up to sixteen events per measure (see **Fig. 3**), you create patterns that will loop forever. All patterns are "live," meaning any changes you make will take effect while the pattern plays back. Dozens of patterns can be loaded simultaneously, and moving through them is as simple as clicking with the mouse.

You can also build a text-based Pattern List containing up to 100 patterns and move among its contents randomly without ever missing a beat. *The Drums* comes with a General MIDI drum kit (key mappings), as well as templates for numerous popular drum machines and synths, including the Alesis HR-16 and the Roland D-10. (The registered version adds support for SMF import and export.) It's an extremely flexible tool that's especially suited to live-performance settings.

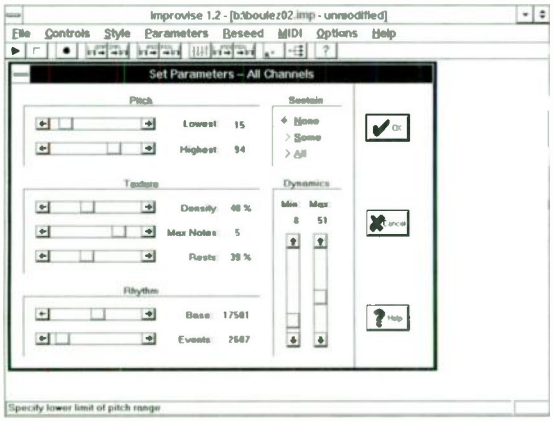

FIG. 4: Numerous note parameters can be changed in real time using *Improvise*, a well-designed algorithmic music generator.

ALGORITHMIC SOFTWARE

Using the computer to generate musical information is one of the oldest techniques around, with some of the earliest important experiments dating from the mid-1950s. Several commercial programs are available for the PC, but two shareware programs, *Improvise* and *Aleatoric Composer*, are noteworthy. Both can create MIDI files for use by other programs or, using the *MIDIMUX* virtual driver, can send their output directly to a notation program. Of the two programs, *Improvise* has the distinct edge as a live performance tool, as changes can be made to the program in real time.

Improvise (Impvz120.zip; $25), by David Pannett, runs under *Windows* and uses a bank of sliders to control various note parameters, such as pitch, Velocity, and rhythm (see **Fig. 4**). Changes take effect as you make them, and it won't be long before you have firm control over what the program generates. You can make subtle changes to your music, for example, by simply increasing the proportion of rests to notes, or have your "improvisation" head in a totally new direction by "reseeding" all parameters. The program can be configured so that changes to a parameter affect notes on all MIDI channels simultaneously, or only on the selected channel.

Improvise can be loaded multiple times, allowing you to build long, time-varying compositions. Simply set the parameters of each instance differently, then move among them randomly or in succession. There are two basic styles for improvisation, Jazz and Experimental, plus loads of options, including a mixer for controlling MIDI volume on any or all channels. The program provides excellent context-sensitive help and is well designed. A forthcoming release, which I've seen in beta, will accept MIDI file input, giving you endless variations on your source material.

Aleatoric Composer (alcomp10.zip; $1), by Carl Christensen, is also designed to generate random music (see **Fig. 5**). The program is highly graphic, with several layers of screens available to precisely control note settings. *Aleatoric Composer* allows you to determine the type of distribution you want for each parameter; for example, you can specify how likely it is that any particular pitch will be generated, or simply have the program use standard distributions (linear, Gaussian, Poisson, etc.) to make that determination. Probability weightings for specific rhythmic values between a whole note and a thirty-second note can also be assigned. Changes in MIDI channels and program numbers can be scheduled to occur throughout the music, but no changes can be made once the program starts to generate notes.

BEYOND MIDI

Beyond the world of commercial MIDI software developers and individual shareware authors is the vast arena of the university and music research center. Many such institutions develop software, sometimes for their own use, sometimes for general distribution. By accessing the Internet (see "Shareware Sources" sidebar), you can try out many of these programs.

Arguably the most powerful software available to computer musicians is *CSOUND*, a complete sound-synthesis language that is used to compile waveform data on your hard disk. Using *CSOUND*, you can design complex, additive-synthesis "instruments," with individual, time-varying frequency and amplitude components for hundreds of oscillators, or use FOF (formant synthesis) to synthesize speech with great precision. Physical modeling has been much in the news lately, and you can try this technique out right now with *CSOUND*'s Pluck generator, which models stringed instruments based on the Karplus-Strong algorithm. These and hundreds of other possibilities exist if you're willing to do just a few lines of typing.

CSOUND creates sounds on disk using two source files: an Orchestra file, in which sounds are designed using the customizable algorithms supplied by the language; and a Score file that specifies when and for how long they should be "played" (see **Fig. 6**). Once these two files are created (any text editor can be used), the program generates the resultant data in one of several soundfile formats (Microsoft WAV format is supported, of course). You can then play the files using your sound card and make additional edits using a wave editor. I regularly create high-quality, 16-bit samples using *CSOUND* and transfer them to my Kurzweil K2000 sampler, giving me the added dimension of complete MIDI control over these sounds.

```
                Chowning Single Carrier FM Instrument in CSOUND Format
                    Selected from the Boulanger Csound Anthology
sr = 44100                                  ; sample rate
kr = 4410                                   ; control rate
ksmps = 10                                  ; sr/cr
instr 1
   ; p4  = amplitude of output wave
   ; p5  = carrier frequency in Hz
   ; p6  = modulating frequency in Hz
   ; p7  = modulation index 1
   ; p8  = modulation index 2
   ; p9  = carrier envelope function
   ; p10 = modulator envelope function

   i1 = 1/p3                                ; one cycle per duration of note
   i2 = p7 * p6                                   ; calculates deviation for index 1
   i3 = (p8-p7) * p6                        ; calculates deviation for index 2

   ampcar   oscil   p4,i1,p9                ; amplitude envelope for the carrier
   ampmod   oscil   i3,i1,p10               ; amplitude envelope for the modulator
   amod     oscili  ampmod+i2,p6,1          ; modulating oscillator
   asig     oscili  ampcar,p5+amod,1        ; carrier oscillator
        out         asig
endin
```

FIG. 6: *CSOUND* is a complete sound-synthesis language used to compile waveform data on your hard disk. Many types of synthesis are possible, including additive, FOF (formant synthesis), and physical modeling.

Exploding the Sound Barrier. Until now, wavetable synthesis and sampling have been the domain of the high-priced keyboard manufacturers. The $199 Turtle Beach Maui™ card brings high quality 16-bit wavetable synthesis to your PC at a price that will leave you breathless. Maui is fully compatible with all Windows MIDI software and DOS applications that support the MPU-401 standard.

Did we mention that Maui comes with a full 2 meg General MIDI instrument set in ROM? You can keep the factory GM sounds or overlay them with your own. You can use any Windows .WAV file as a MIDI instrument. Unbelievable!

With Maui installed, your PC becomes a 32-voice sample playback engine with up to 8.25 megs of RAM (256K included) for about the same price you would pay for a power cord for one of those $2,000 samplers.

Plus, there's Wave/SE™ sound editing software. Not only can you edit standard Windows wave audio, but Wave/SE is perfect for sample editing and uploading your work to the synthesizer.

See your favorite dealer or call us at 800-645-5640 for more information today!

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Wavetable Synthesizer Upgrade

TURTLE BEACH SYSTEMS

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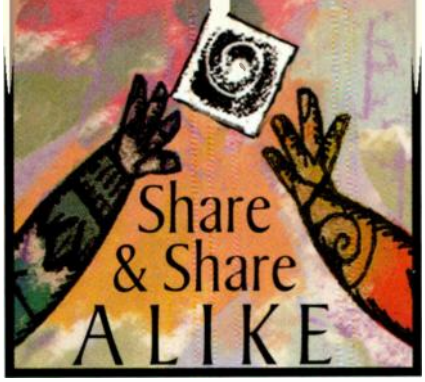


The version of *CSOUND* you'll find on the Internet (ftp to ftp.bath.ac.uk and locate the version for your CPU in the pub/jpff directory) comes with numerous examples and an extensive reference manual, as well as short tutorials on several of the program's features. (A forthcoming anthology by Dr. Richard Boulanger of the Berklee College of Music will be the definitive guide to *CSOUND* instrument design.) If you're interested in the most advanced synthesis language around, give it a try.

Another university-based offering is the Carnegie-Mellon *MIDI Toolkit*. The *Toolkit* includes executable programs and a compiler for generating your own code. Included with the package is *Adagio*, a MIDI programming language in which various note parameters are written in plain ASCII text; for example, the letter "W" means whole note, "H" means half, etc. The Toolkit can be used to create sophisticated real-time modules in which, for example, a performer triggers a long sequence of events simply by pressing a sustain pedal. Extensive MIDI processing such as that found in the included *Echoes* application can also be accomplished. *Echoes* returns a string of repeating, delayed notes for every pitch it receives.

▼

Arguably the most powerful software available to computer musicians is *CSOUND*.

Although it is technically freeware, if you plan to develop programs for sale with *Toolkit*, you will need to work out a licensing arrangement with CMU. *Toolkit* is available online from g.gp.cs.cmu.edu in the /usr/rbd/public/cmt/dos directory. You can also get disks directly by mail.

SUMMARY

I've only covered a small fraction of the programs available online; there's a mind-boggling selection to choose from. New programs become available on a daily basis, and for the most part, shareware authors seem as interested in keeping their programs up to date as their commercial counterparts. So whether you're after the perfect little utility, or a whole new way to work with sound, the world of shareware is definitely worth exploring. And of course, you can't beat those prices!

Dennis Miller *is on the music faculty of Northeastern University in Boston. He spends much of his time saying "no" to projects that would keep him from writing music.*

1500 SERIES

WHATEVER YOU DO — DON'T BUY THE WRONG MIXER.

Especially if you're doing multitrack recording — whether digital or analog. Fact is, a mixer that's not specifically configured with the features essential for multitrack recording just isn't a recording mixer. Bottom line is, general purpose mixers make multitrack recording a nightmare.

You see, mixers that aren't designed and engineered for multitrack recording will torture you with the endless hassle of patching and repatching — every time you track, overdub or mixdown. It's frustrating, wastes valuable time and leaves you tangled in cable.

So before you choose a mixer for your studio — be sure it has the features of a dedicated recording mixer.

IT'S NOT A RECORDING MIXER IF IT DOESN'T HAVE THESE FEATURES.

MULTITRACK DECK CONFIGURATION

If you don't have dedicated inputs and outputs for your 8-track deck, where do you plug it in? Without this basic recording configuration you'll be repatching day and night and you won't be able to record on 8 tracks at once. With these inputs, tape monitoring is as simple as pressing a switch. Also, because the TASCAM M1500 is a true 4-buss mixer, you can mix any combination of your input signals to any of the 4 output busses directly to tape.

SWEEPABLE MIDRANGE EQ

Ask for it. Because when it comes time to tailor your sound, you need the flexibility where the action is — in the midrange. The M1500's sweepable midrange lets you isolate specific mid frequencies allowing you to make the subtle tonal corrections you want.

DIRECT OUT AND GROUP OUT ASSIGNMENT SWITCHES

You gotta have these. Because without them you can't directly send a single input to tape, or record several inputs to one track. But with them, assign your inputs anywhere by pressing a few switches. Best part is, you'll never have to refer to any complex patch diagrams.

ELABORATE MONITORING

In a recording environment you need to hear what's going through your board at all times. With the M1500's comprehensive monitoring matrix you are able to hear any sound source at any time — inputs, tape, AUX sends, anything — it's your choice, just press a switch.

IN-LINE MONITORING

A sure sign of a recording mixer. This lets you monitor your tape tracks at any time without sacrificing an input channel. Just press a switch. With the M1500's dual section not only can you monitor tape tracks, it can be used for additional effects sends, or to double your inputs for virtual tracking at mixdown. And do any of this by flipping a switch.

TRUE TRANSPARENCY AND LOW NOISE

In recording, your signal goes through the mixer several times. And each time it goes through, it is important not to lose or gain anything. Especially an identifiable "mixer sound." Test any mixer for its transparency. Take any signal and bounce it 3 or 4 times on your favorite digital recorder. With the truly transparent M1500, you'd be hard pressed to differentiate between the bounced tracks and the original signal.

At TASCAM, we've been making multitrack recording equipment for more than 20 years. We pack that experience into every mixer we make — and we make more recording mixers than any other company in the world.

For our M1500 Series of recording mixers, the result is an affordable mixing console configured for 8-track recording. A truly transparent mixer that makes tracking, overdubbing, and mixdowns easy. An extraordinarily flexible console loaded with the features and specs you'd expect on consoles costing thousands more.

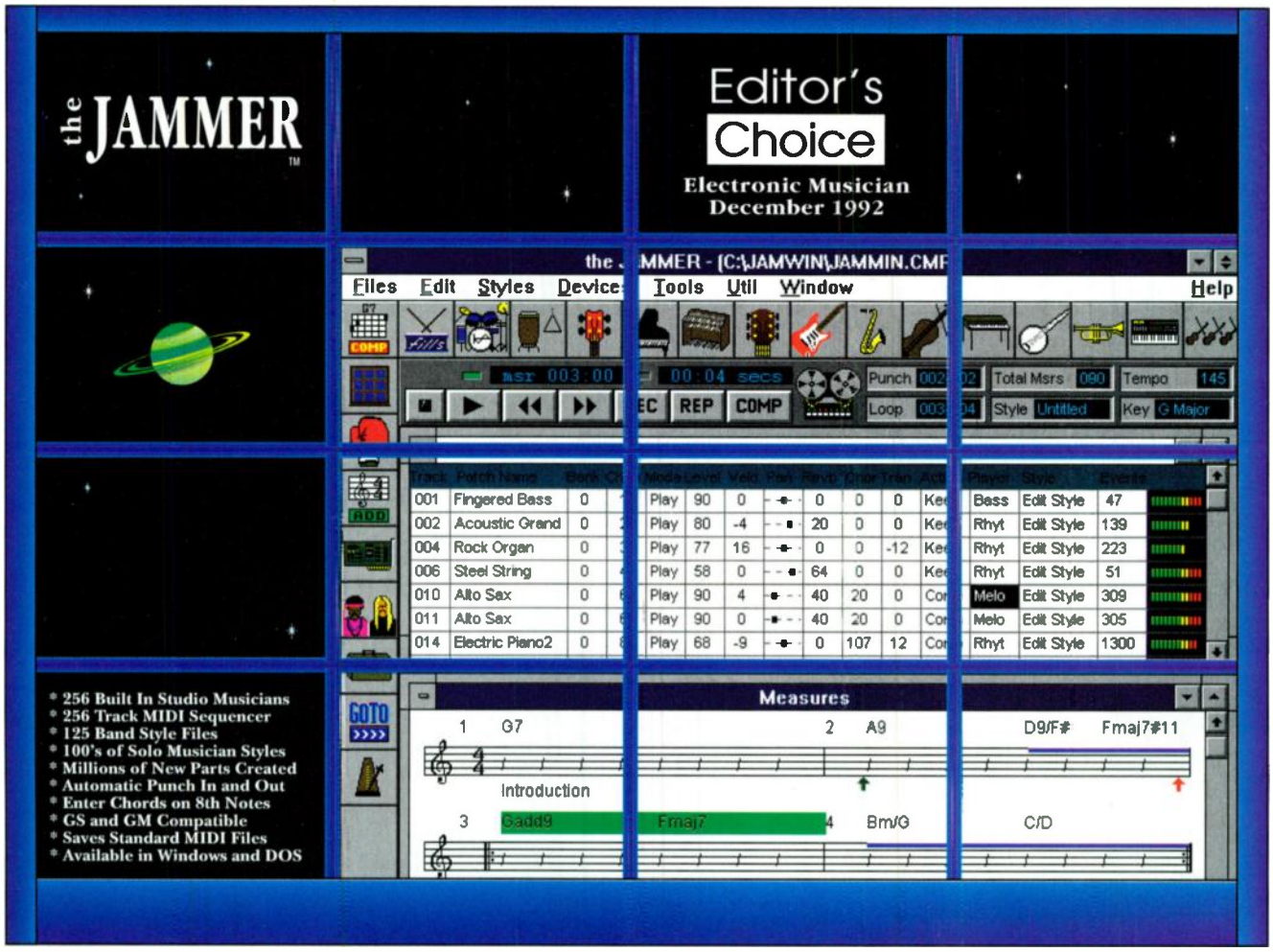
But the M1500 Series of recording mixers are priced less than many general purpose mixers on the market. They're available in a 16-channel/32-input tabletop version (M1516) and a compact rack mountable 8-channel/16-input version (M1508). So if you're involved in digital or analog 8-track recording, you've just found the best recording console value in the industry.

TASCAM M1508 $1099 M1516 $1699

Get your hands on a true recording mixer today: the TASCAM M1500 Series. There's one waiting for you at your authorized TASCAM dealer. Go ahead — test it and play with it. It's your next recording mixer.

TASCAM
Take advantage of our experience

NOW AVAILABLE IN WINDOWS ...



Take a seat in the Producer's Chair and get ready to create a musical masterpiece. An array of talented Studio Musicians and a 256 track MIDI Studio are all at your command. Not to be confused with 'automatic accompaniment' programs which play back 'canned' or pre-recorded parts, the JAMMER combines music theory, artificial intelligence and randomness to create new quality musical parts for you each time you recompose. You bring the musicians in and out, you select the measures to be composed, you control the style of each musician on each track. You set the levels, pans, effects, and do the final mixdown. You control it All ! We took the time-consuming work out of creating music, but when it comes to control ... We saved it all for you.

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SERVICE CLINIC

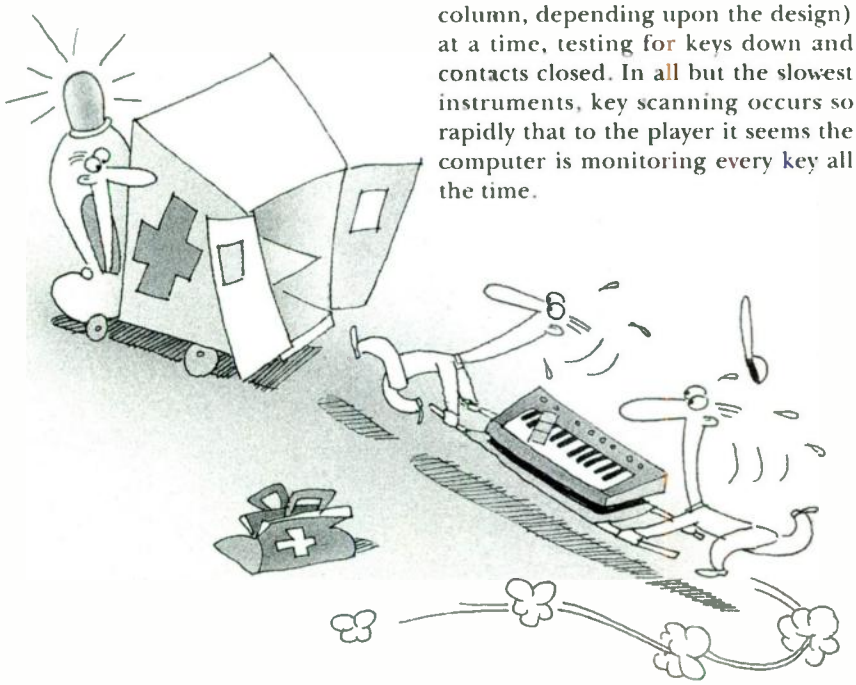
Questions and Answers

Our intrepid tech takes you where the action is.

By Alan Gary Campbell

Q One key on my Roland S-50 sampler won't work; it was intermittent for a while, then quit. The note plays through external MIDI control. The local technician says it's the diode. Does this sound reasonable? How can you decipher various keyboard problems?

A. Most synths and samplers have keyboard-decoding circuits that "look at" the keyboard contacts in a matrix of ordered rows and columns. The computer inside the instrument scans the contacts, one after another, a row (or column, depending upon the design) at a time, testing for keys down and contacts closed. In all but the slowest instruments, key scanning occurs so rapidly that to the player it seems the computer is monitoring every key all the time.



JACK DESROCHER

In an older, non-velocity-sensing instrument, a detected "key-down" event is simply assigned to trigger a voice. In a velocity-sensing instrument, the control circuit is somewhat more complicated. Two contacts are provided per key: a normally-closed upper contact and a normally-open lower contact. The computer initially scans for an open upper contact. When one is detected, a timer is started, and the affected key is monitored to measure the time-of-flight to reach and close the lower contact. Because the distance between contacts is known, the velocity can be computed once the time-of-flight is measured. This is an oversimplification, but serves to illustrate the process.

Scanned keyboards work well and offer reduced cost, as a single key-interface circuit can be multiplexed to monitor an entire keyboard. (Purists will argue that the only way to make a keyboard respond naturally and with minimum key delay is to provide a separate interface for each key, but that would be quite expensive.) Wiring harnesses and connectors are simplified, as well. For a standard, 5-octave, 61-note keyboard, an 8 × 8 matrix (64 contact positions) will handle all the keys and three additional contacts (e.g., for footswitches), yet can be connected via a modest, 16-pin cable.

Diodes—typically one pair per key-contact—are employed to keep the

Automatic Accompaniment has arrived – ...and just got better with Version 5

BAND-IN-A-BOX™

INTELLIGENT SOFTWARE FOR IBM (DOS & WINDOWS), MAC & ATARI

Type in the chords to any song, choose the style you'd like and Band-in-a-Box does the rest...

Automatically generating professional quality five instrument accompaniment of bass, drums, piano, guitar & strings in a wide variety of styles

24 Styles built in...

Jazz Swing • Bossa • Country • Ethnic • Blues Shuffle • Blues Straight Waltz
Pop Ballad • Reggae • Shuffle Rock • Light Rock • Medium Rock • Heavy Rock
Miami Sound • Milly Pop • Funk • Jazz Waltz • Rhumba • Cha Cha • Bouncy 12/8
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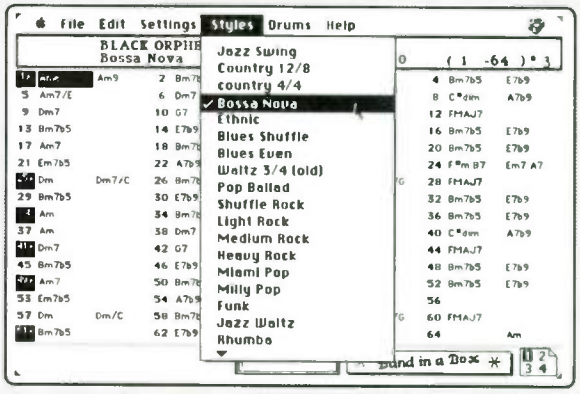
Version 5: 2 more instruments + built-in sequencer...

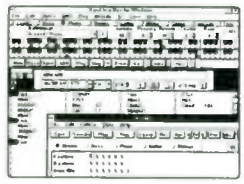
The built-in sequencer lets you record melodies (or buy our MIDI-FAKE-BOOK disks which include chords & melodies). Also make your own 5 instrument styles using the StyleMaker™ section of the program – or edit our styles to your tastes. Now there are 5 accompaniment instruments (including guitar/strings). General MIDI standard implementation (even for old synths). Plus 70 other new features!



NEW! Band-in-a-Box Pro for Windows $88

The award winning Band-in-a-Box automatic accompaniment program is now available for Windows 3.1. All of the features of the DOS version, plus much more including...

- *The "Wizard" (intelligent playalong features)*
- *background playback in other programs*
- *support of all MultiMedia drivers (Roland MPU401, Soundblaster, MultiSound, AdLib, TG100, etc.)*
- *copy MidiFiles to Clipboard to paste into other Windows music programs*
- *onscreen toolbar, full mouse support*
- *fully featured Windows interface*
- *all files fully compatible with DOS, Mac & Atari versions!*



UPGRADE OFFER FOR EXISTING BAND-IN-A-BOX USERS:
Basic upgrade to Band-in-a-Box Pro for Windows – $29
Complete Upgrade including new 5 instrument styles disk #4 – $49

BONUS!! Band-in-a-Box IBM version now includes BOTH the Windows AND DOS version for the same price!!

STYLES DISK #4 (Mac/Atari/IBM) $29

34 Hot new styles for Band-in-a-Box

We've made our best styles disk ever, most utilizing 5 instruments at a time. (bass/drum, piano, guitar and strings) This disk Supercharges your Band-in-a-Box program!!

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(Charleston, Dixieland, Fats Waller, Jazz Quintet, Jazz Fast, Lui Prim Style. Tango, Jaco 5, ChaCha 5)

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(Chet, Cryin, Country Ballad, Country Contemporary, Floyd Piano, Ozark, Folk, J Cash 5)

7 NEW POP STYLES !
(Breezin, Larry, Grover, Kladrman Piano, St. Elmo, Yesterday, Georgia Style, On BoardWalk)

4 NEW "OLD POP" STYLES
(Supremes, "Sam Cook" Style, J B Goode, Fats D)

6 NEW ETHNIC/MISC. STYLES
(Gumbo, Klezmer1, Klezmer2, March_12, March_16, Mozart)

WE DIDN'T SAY IT... PC MAGAZINE DID!

– FINALIST –
PC Magazine Award
for Technical Excellence

AFTER HOURS / ENTERTAINMENT
Band-in-a-Box
PG Music

"This amazing little program from PG MUSIC creates "music-minus-one" accompaniments for virtually any song any style. You simply type in the chords, pick a tempo and one of 24 styles, and the program creates nicely embellished chords, a bass part, and drums to be played on a MIDI synthesizer. Band-in-a-Box understands repeats, choruses and verses, and even varies the accompaniment, just as human musicians would. Peter Gannon, the author of the program makes no claim to artificial intelligence, but Band-in-a-Box is software that repeatedly surprises and delights you, especially in its jazz styles."

PC Magazine Jan. 15, 1991 – Technical Excellence Awards

DownBeat – the #1 Jazz Magazine says...

"Band-in-a-Box is the most significant contribution to Jazz Education since Jamey Abersold Records."

"Band-in-a-Box is an amazing program"
Keyboard Magazine Aug. 1992

"I am in awe. I didn't think that such an incredible program could even exist. This software is a dream come true."
PC Journal Sept. 1992

Band-in-a-Box Prices

New customers

Band-in-a-Box Standard Edition (24 styles)	*$59*
Band-in-a-Box PRO version (75 styles)	*$88*

(BONUS!! Band-in-a-Box IBM version now includes BOTH the Windows AND DOS version for the same price!!)

Upgrades & add-ons

Upgrade or Crossgrade (Windows/DOS/MAC/ATARI)	*$29*
("CrossGrades" are for users who need a version for a different type of computer)	
Midi-FakeBook with melodies (100 songs on disk)	*$29*
Styles Disk #2 (25 new styles for Version 5)	*$29*
New! Styles Disk #4	*$29*
Any 2 of Above	*$49*
Any 3 of above	*$59*
(eg. Upgrade to Windows + Styles Disk #4 = $49)	

Requirements:

IBM-DOS: *640K, MIDI interface or soundcard (MPU401, SCC1, Midiator, SC-7, TG100, Yamaha C1, Voyetra VAPI, Adlib)*
IBM-Windows 3.1: *2mb memory. Any MIDI interface or soundcard.*
MACINTOSH: *2mb memory, system 6 or 7 (reduced version for 1mb available)*
ATARI: *1040ST/STE/MEGA/TT (reduced version for 520 users available)*

From PG Music... *The makers of The Jazz Guitarist, Band-in-a-Box, PowerTracks, The Pianist*
☎ *Phone orders: 1-800-268-6272 or 1-905-528-2368 VISA/MC/AMEX/cheque/mo/po# Fax 1-905-628-2541*
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PG Music Inc. *266 Elmwood Avenue Suite 111 Buffalo NY 14222*

PG Music announces... lots of new software programs!!

(6 Windows programs, 2 DOS programs, 3 MAC programs & 3 Atari programs!!)

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INTELLIGENT SOFTWARE FOR IBM (Windows/DOS), MAC & ATARI COMPUTERS

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- built-in sequencer lets you record melodies (or you can buy our MIDI-FAKEBOOK Disks of songs).
- Pro version comes with 75 styles: Including Jazz Swing, Bossa, Blues, Jazz Waltz, Pop Ballad, Reggae, Rock (15 styles), Country, Miami Sound, Funk, Rhumba, Cha Cha & over 60 more!!
- Make your own styles or edit our styles using the StyleMaker section of the program.

Finalist - PC Magazine Award

***DownBeat**, the #1 Jazz Magazine says... "Band-in-a-Box is the most significant contribution to jazz education since Jamey Abersold records."*

AFTER HOURS / ENTERTAINMENT

ADD-ONS AVAILABLE TO PRO VERSION

Midi FakeBook disk (100 songs) + 25 new styles	$30	Styles Disk #4 (5 instrument, 30 styles)	$29
Upgrade to Windows version from DOS (+ styles disk #4)	$49	Upgrade to version 5 (complete)	$59

Requires: IBM (640K, any MIDI interface/soundcard), Atari 1040, Mac 2 mb RAM

BONUS!!

IBM version now includes BOTH the Windows AND DOS version for the same price!!

The Pianist™ (Windows, Mac, Atari) $49

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PERFORMED BY CONCERT PIANISTS!

All the pieces have been recorded "in real time" by concert pianists on an 88 note weighted MIDI piano keyboard. They are never quantized or step recorded. All pieces are complete performances professionally performed, recorded & saved as Standard MIDI files. You therefore hear the music playing with CD-quality through your sound card or MIDI system.

ALL YOUR FAVORITE MUSIC...

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Play/Stop/Pause/Rewind/Tempo change/transposition/Volume/panning/patch changes & more.

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"Incredible... amazing... terrific... masterful... fabulous... love it... my favorite program!"

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THIS PROGRAM MAKES IT "TOO EASY" TO LEARN TO BE A GREAT JAZZ GUITAR PLAYER!

A music program containing a huge collection of over 60 jazz standards played on MIDI guitar by top jazz/studio guitarist Oliver Gannon

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Hear the music with CD-quality through your sound card or MIDI system. Most pieces have bass/drums as well as guitar so you get a full sounding jazz trio for the tunes!

the Jazz guitarist from PG Music Inc.

LEARN TO BE A GREAT JAZZ GUITAR PLAYER!

On-screen fretboard shows you exactly what notes & chords are being played on the guitar. Slow down the performance or, better still, step through the music chord by chord, so you can learn every note as it's played!

PLUS MANY MORE FEATURES...

- *Jazz Trivia Game & Guess That Song Game, Program Notes, Biographies (all on disk)*
- *Over 60 Top Jazz Standards with Complete Guitar Arrangements*
- *Listen to the music while you work in other programs*
- *Special support for Roland GS or General MIDI Modules*
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- *Use your existing sound card or MIDI synthesizer*

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Mixing/editing/storage of EVERY feature on Sound Canvas & other Roland GS & GM modules

You'll never need to touch your Sound Canvas front panel or open the manual again! Edit/design new sounds, new scales, tunings... YOU CAN EDIT EVERYTHING!!! Also plays MIDI files (hear changes as you make them).

Multi-MPU401 Driver for Windows $19

- *allows 8 music programs to use the same MPU401 at the same time!*
- *a "must have" driver for all MPU401 Windows users (Roland, Music Quest, CMS, etc.)*
- *easy to use, installs as a driver in Windows to replace your current MPU401 driver*
- *NEW! Allows inter-program MIDI communication!*

The current MPU401 Driver for Windows only allows one music program to use the port at a time. You need to close down all music applications before running a new one. But the new "Multi MPU401 Driver" allows up to 8 programs to use the MPU401 at the same time. So you can use all of your music programs at the same time.

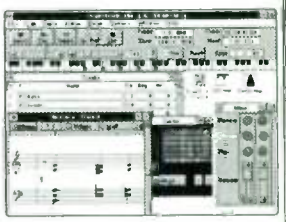
NEW! Music Printout!

PowerTracks Pro™ $29

SEQUENCER/NOTATION/PRINTING FOR WINDOWS (IBM)

"Solid sequencing at an unbelievable price" Electronic Musician Sept. 93

PowerTracks Pro 2.1 is a professional full featured MIDI sequencing, notation and printing program, and is so easy to use! And we include versions for Windows AND DOS, so you'll be able to use PowerTracks PRO on all of your machines!



PRO RECORDING, PLAYBACK, SYNCH, EDIT & SYS-EX OPTIONS

48 tracks, real-time/punch record, sound-on-sound, MIDI File support, sync (SMPTE, Midi Time Code, MIDI), edit (quantize/cut/copy/paste/undo/data filters/transpose), multi-port support, 480 ppq timebase, sys-ex editor, librarian, patch names, banks & much more.

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Enter and display music in standard Music notation. Intelligent/automatic features such as: Correct beaming/typing of notes, measure rests, guitar "Jazz Eighth notes" option (this automatically allows jazz swing eighth notes & triplets to be notated properly!!), Reads in any MIDI File & displays it as notation!!

MUSIC PRINTOUT (ON ANY PRINTER!!)

Print any track in standard music notation. Selectable staves per page, and bars per line. Selectable margins and paper size. Portrait or Landscape (sideways) printing. Titles, composer, style, copyright/permission. Make your own lead sheets! You can also print the piano roll window for even more detailed analysis of a track!

DELUXE WINDOWS INTERFACE

Multiple Windows – Music Notation, Staff Roll (piano roll), Event List, Tracks, Bars, Meter, Tempo, Piano keyboard, Guitar fretboard.

SO MUCH MORE...

- *Juke Box built in to play back sets of songs*
- *Comprehensive guitar support (on-screen fretboard, record/enter/edit/play guitar music)*
- *Built in mixer /sound editor for Roland Sound Canvas/SCC1/GS series.*
- *Comes with Pro quality MIDI files (piano, guitar, combo music by studio musicians)*

POWERTRACKS FOR DOS VERSION INCLUDED FREE. Yes! We include the DOS version for free in the same package. NOTE: The DOS version doesn't support music notation, or other graphical features.

EXISTING POWERTRACKS USERS CAN UPGRADE TO POWERTRACKS PRO 2.1 FOR ONLY $10.

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(Windows, Mac, Atari)

THIS PROGRAM MAKES IT "TOO EASY" TO LEARN TO BE A GREAT JAZZ PIANIST!

Top jazz/studio pianists play 60 jazz standards in a wide variety of styles.

RECORDED IN REAL-TIME ON A MIDI KEYBOARD!

Hear the music with CD-quality through your sound card or MIDI system. Most pieces have bass/drums as well as guitar so you get a full sounding jazz trio for the tunes!

the JAZZ PIANIST from PG Music Inc.

LEARN TO BE A GREAT JAZZ PIANIST!

On-screen piano keyboard shows you exactly what the pianist is playing. Slow down the music or step through it chord by chord. Learn the music "note for note" by watching the piano notes on screen. Load the MIDI files into your favorite programs for further study or enjoyment. Complete artistic professional performances with CD-quality sound!

PLUS MANY MORE FEATURES...

- *Jazz Trivia Game & Guess That Song Game, Program Notes, Biographies & Music Dictionary (all on disk)*
- *Over 60 Top Jazz Standards with Complete Jazz Piano Arrangements*
- *Listen to the music while you work in other programs*
- *Special support for Roland GS or General MIDI Modules*
- *Copy the Standard MIDI files & use in other programs/presentations*
- *Use your existing sound card or MIDI synthesizer*

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key contacts from interacting when scanned. Because the diodes are related to the function of the scanning matrix, they are often referred to as *matrix diodes,* or *keying diodes.*

The key contacts also are part of the reliability profile. Conductive-rubber switch contacts—the so-called "membrane" switches that come in dome and tube types (see **Fig. 1**)—often simply wear out. (Metal, self-wiping types, such as those used in the Korg M1 and Yamaha DX7, have a long life and are generally maintenance-free. But keys inadvertently jammed from front to back can cause serious contact damage.)

Understanding these basic concepts helps to demystify keyboard symptoms. Failure of a single key, preceded by some period of intermittent operation, is most likely caused by a bad or contaminated contact. A failing membrane-switch contact, whether dome or tube type, will normally be intermittent for a time, then fail. It can sometimes be coaxed to play briefly if the key is restruck rapidly or pressed forcefully. (Neither procedure is advisable.)

Cleaning the contact may bring it back to life momentarily, not by repairing the problem, but simply by jostling the aging rubber. But the problem will soon recur. A torn dome or membrane may be repaired in an emergency by applying a tiny amount of Elmer's Stixall adhesive to the tear. Replacement of a worn-out membrane switch is the only reliable fix.

Contamination may also cause intermittence before total failure, but if the contamination is significant (e.g., a dead bug), the period of intermittence will be brief. There is some variability, but a significantly contaminated key generally will not come "back to life" without service. Fortunately, cleaning the contact is usually all that is required.

A defective diode can certainly cause a nonfunctioning key, but is infrequent and would not normally become intermittent before failure. To replace a defective diode without removing the affected printed circuit (PC) board, clip the leads of the defective part close to the body and tack-solder the new diode to them. Be careful not to overheat the replacement.

Rarely, an open PC trace on the keyboard-contact board causes a single, nonworking key. Depending upon the severity of the trace break, the problem may be intermittent and may respond to flexure of the board or key frame. Unless the instrument has been damaged, the break may be visually undetectable. If so, it will be necessary to scrape away some of the mask from the traces at appropriate points to check continuity. A digital multimeter (DMM) with an audible continuity indicator is helpful.

An open trace outside the contact area can be repaired by tack-soldering a small-diameter jumper wire across the break. An open trace in the contact area (e.g., underneath a membrane "dome") can be repaired with a tiny piece of E-Z Circuit, or similar self-adhesive copper foil. But because that part of the board must be free of significant protuberances, tack-soldering this can be troublesome. Note that a damaged instrument may have multiple dead keys or other problems. In this case, it may be simpler to replace the key-contact board.

When a single row or column is out, the problem is usually caused by a defective subcircuit (often one gate of a multidevice package), an open keyboard-cable lead, a loose connector pin, a bad solder joint or (rarely) an open PC trace. This type of failure has a specific, unmistakable symptom: Across the keyboard, keys at the interval of the matrix height (or width) will be dead. For example, on a 61-note keyboard, every eighth key will be out.

Checking the interconnections of the dead keys against a schematic reveals which row or column (sometimes more than one) is out. Cable, connector, and trace continuity can be checked with a DMM. You can check defective scan-circuit ICs with an oscilloscope and swap a socketed IC with a part known to be good.

None of these problems affect the audio or MIDI circuitry, so any "dead key" notes will play from an external MIDI controller.

Finally, if the keyboard-interface circuit fails, the keyboard won't play at all. (This can also happen if Local Control is inadvertently turned off.) In contrast, a dead or malfunctioning voice—a problem with the audio circuitry—often "moves around" the keyboard as the bad voice is reassigned to different notes. The effect is similar under MIDI control.

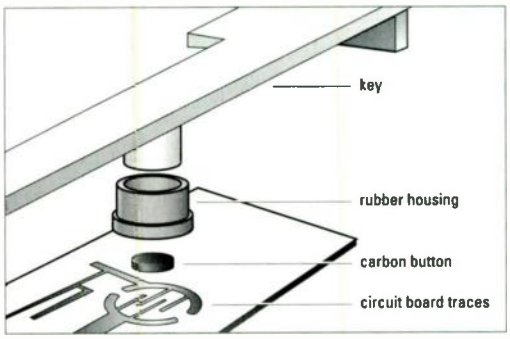

FIG. 1: Exploded view of a keyboard membrane switch. Normally the button sits in the rubber housing, a fraction of an inch above the board traces. Pressing down on the key pushes the carbon against the circuit board, completing the connection between the two traces.

In many respects, keyboard-circuit repair is straightforward. But the safe disassembly of a high-tech instrument requires considerable experience. Current designs often require the removal of dozens of screws and other fasteners. You may have to do a lot of disassembling, including the removal of numerous static-sensitive circuit boards, to get to the keyboard. As a do-it-yourself project, keyboard-contact repair is not advisable for the beginner.

(General considerations regarding the service life of membrane and DX-type switches were discussed in the April 1993 "Service Clinic.")

MINIMOOG MOD-POT MOD MOD

In the February 1994 "Service Clinic," the text of my reply regarding the Minimoog mod-pot bleedthrough fix was slightly compressed by the editors, a normal and generally benign editorial procedure. In this case, however, sentences that I had connected via cautionary conjunctions became separated and, after editing, the first sentence of paragraph 2 read: "Fortunately, considerable improvement is often obtained by replacing the worn pot with a standard, good-quality (Allen Bradley or similar), heavy-duty, 50 kΩ, 2W, audio-taper pot."

This implies that simply replacing the pot, without rewiring the control circuit, might fix the problem. In all but the rarest cases, it will not. Rewiring is necessary to stop the bleedthrough.

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

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Taking it on the Road

Multimedia mavens move and groove with music and graphics.

By Michael Brown

As the concept of multimedia takes flight in the public eye, producers are taking flight in jumbo jets with multimedia workstations on their tray tables. Equipped with a portable computer—and an extra battery or two—you can travel almost anywhere and tote along a complete studio wherever you wander.

Multimedia means sound, color graphics, and video. Portable computers have been around for years, but the components required for multimedia production—CD-ROM drives, color displays, large-capacity hard drives, sound cards, and stereo speakers—have bound multimedia to the desktop and kept producers tethered to their studios; that is, until now.

Heavy but powerful, the 17.1 pound Toshiba T6600C lunch bucket features built-in stereo speakers, 520 MB hard disk, and room for an internal CD-ROM drive.

MIGHTY MITES

The newest generation of portable computers, coupled with the miniaturization of critical peripherals, has severed those bonds. PC-compatible and Macintosh users can choose from dozens of different portable computers.

Unfortunately, Atari and Amiga users are out of luck when it comes to computing on the go. Commodore has never offered a portable Amiga, and the company has no plans to produce one. Atari's only currently available portable computer is the DOS-based Portfolio palmtop. The company discontinued its portable ST, the STacy, some time ago. Atari has no current plans to offer a portable version of its Falcon030.

Portable computers can be divided into three basic categories: palmtops, laptops, and lunch buckets. Laptops can be further subdivided into notebooks and subnotebooks. Palmtops are small enough to fit in a coat pocket; subnotebooks are slightly larger. The diminutive construction of palmtops makes them great for jotting down

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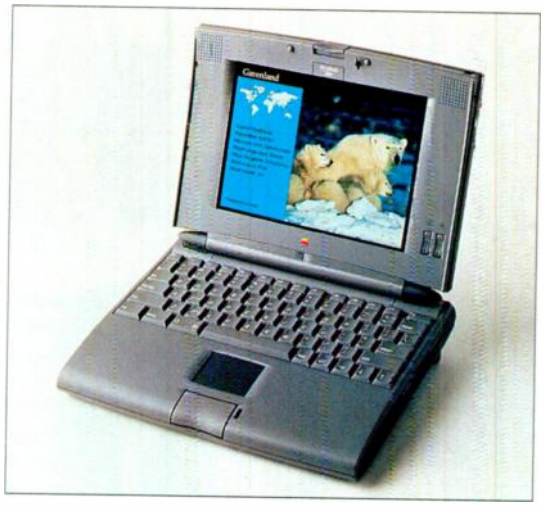

FIG. 1: Now equipped with 16-bit stereo sound, Apple's new PowerBooks deliver much more multimedia punch than previous Macintosh portables.

ideas, but the absence of color video and expansion capabilities limits their usefulness for multimedia production. Subnotebooks are somewhat better, but many, including Apple's PowerBook Duos, achieve their petite dimensions by excluding a built-in floppy-disk drive. Often, compromises made to reduce bulk reduce performance, as well.

Weighing less than seven pounds, notebook computers are easily transported. This makes them ideal for musicians who want the same sequencer on stage that they use in the studio. Notebooks are also great if you do most of your arranging in your home studio and perform your final mastering at a commercial studio. By simply plugging your portable computer into their system, you're instantly productive in your own, familiar work environment.

What you gain in portability, however, you sacrifice in internal functionality. With most notebooks, peripherals such as CD-ROM drives, sound cards, and speakers are connected externally, which means they must be detached and stored for transport.

IBM's ThinkPad 750C ($4,699) is an excellent multimedia notebook. The 750C is powered by an Intel 80486SL microprocessor running at 33 MHz. (The SL is a low-power version of the '486 with an integrated math coprocessor.) Its large (10.4-inch), active-matrix, color, 640 × 480 LCD display can produce 256 simultaneous colors from a palette of 262,000.

Active-matrix displays drive up the price of a portable computer considerably, but less-expensive, passive-matrix and dual-scan color displays are not nearly as bright, making them hard to see on a dark stage. Because they have slower screen-refresh rates, these other types of displays have a tendency to smear when displaying animation and digital video. Active-matrix displays aren't hindered by these problems.

In addition to high-quality displays, more and more notebook-computer manufacturers are building sound capabilities into their machines. IBM's ThinkPad 750 series, for example, features onboard 16-bit sampling at rates up to 44.1 kHz, FM synthesis, mic inputs, and stereo headphone jacks. But be aware of such terms as "business audio." This typically means the computer has the onboard audio hardware to create and play back WAV files, but not MIDI sequences. Sampled audio is

FIG. 2: Docking stations, such as IBM's Dock I, add desktop functionality to portable computers.

nice, but it consumes much more disk space than MIDI files.

Not to be outdone by PC-compatible manufacturers, Apple has added stereo sound and built-in stereo speakers to its new PowerBook 500 series (see **Fig. 1**). Apple elected not to endow the new portables with the DSP capabilities of the A/V Macs, but it did put the A/V's Singer audio chip into the design. In the PowerBook 500-series, Singer provides 16-bit audio sampling and playback capabilities at rates up to 44.1 kHz. The chip features two analog-to-digital converters, two digital-to-analog converters, and audio compression and decompression circuitry. In this sense, the new Mac portables possess the same characteristic as the "business audio" of some PC-compatibles: They can create and play back audio samples, but require an external sound module to play back MIDI sequences.

Should you find the 68LC040 CPU in the PowerBook 500s too limiting, the computers can be upgraded to portable Power Macs when the MPC603 chip becomes available.

PREPARE FOR DOCKING

Several notebook and subnotebook computers come with optional docking stations. Typically, these devices are designed to transform a portable computer into a desktop configuration. IBM's Dock I ($899) is noteworthy because it turns the ThinkPad into a portable multimedia workstation (see **Fig. 2**); it even has a built-in handle. Snap in the 750C and you have stereo speakers; a drive bay for a CD-ROM drive (or other 5.25-inch drive); a full-length, 16-bit Industry Standard Architecture (ISA) expansion slot; two additional Personal Computer Memory Card International Association (PCMCIA) slots; and a SCSI port for adding external devices.

Plug a sound card, such as the Roland RAP-10, into the Dock I, and you have a portable multimedia studio that weighs less than fifteen pounds (including CD-ROM drive). Or you could really go crazy and put a Turtle Beach 56K card into the Dock I's slot and a 1 gigabyte hard disk in its drive bay to create a portable digital-audio mastering workstation.

Apple's new Duo Dock II ($700 to $900 at press time) provides all the functionality of a desktop Mac when you plug a Duo subnotebook computer

into it. The docking station features a floppy-disk drive, two NuBus slots, a port for an RGB monitor, and all the other I/O ports found on a standard Macintosh. The new PowerBooks and DuoDocks also feature Ethernet ports for easy networking. Apple also offers minidocks that provide important I/O capabilities without tying the computer to the desktop.

One of the most important features to look for in a notebook computer, particularly one that doesn't provide onboard sound, is the presence of one or more PCMCIA slots. PCMCIA peripherals are the size of credit cards, and manufacturers have introduced many such products for the multimedia artisan, including sound cards, SCSI controllers, MIDI interfaces, portable hard drives, and RAM cards. You can even connect self-powered speakers to these slots.

For example, New Media's .WAVjammer PCMCIA card ($399) offers Sound Blaster compatibility (it has a Yamaha OPL-3 FM chip onboard) and the ability to record and play back 16-bit samples at up to 44.1 kHz (see **Fig. 3**). The card has a stereo line in, amplified stereo microphone in, and a stereo speaker out (all jacks are ⅛-inch). Turtle Beach's Audio Advantage PCMCIA card ($159) doesn't have an onboard synth, but it does feature a MIDI interface and 12-bit monophonic sampling at rates up to 44.1 kHz.

The PCMCIA standard doesn't exclude the Mac, but Apple has been very slow to adopt it. The company finally changed that situation with the introduction of its new PowerBook 500 series, which supports PCMCIA devices through an optional plug-in module.

LUNCH BUCKET BRIGADE

The most powerful portable computers for multimedia are found in the category known as "lunch buckets." These machines are mobile in that they are self-contained, but they run only on AC current, not batteries. The advantage these computers offer is internal expandability, i.e., you can add hardware peripherals without increasing the overall dimensions of the computer itself.

There are fewer models to choose from in this niche-within-a-niche market. Only a few PC-compatible manufacturers offer lunch buckets; Apple offers none at all. Nevertheless, they are ideal candidates for a portable multimedia or digital-audio mastering system.

The Toshiba T6600C ($7,699) is one of the smallest lunch buckets available. Powered by a 66 MHz 80486 DX2 microprocessor, the T6600C features a 10.4-inch active-matrix color display, 8 MB of RAM (expandable to 40 MB), a 510 MB hard drive, a SCSI-2 port, and two ISA expansion slots. The unit features the Microsoft Sound System

FIG. 3: New Media's .WAVjammer PCMCIA card adds Sound Blaster compatibility to laptop computers, complete with FM synthesis and 16-bit digital-audio recording.

chipset onboard (for Sound Blaster compatibility), built-in stereo speakers, and a 5.25-inch drive bay for a CD-ROM drive or other mass storage. The weight penalty for all that mobile power? The T6600C tips the scales at 17.1 pounds.

Lunch buckets from Dolch Computer Systems carry meals for the truly power-hungry. Their A-PAC (Audio-Portable Add-in Computer) line includes the A-PAC586-60C ($8,995). This is the only portable to feature Intel's Pentium microprocessor (the successor to the 80486 series). Each model in the A-PAC line also features a Media Vision Pro Audio Spectrum 16 sound card, built-in stereo speakers, and a 20-watt stereo amplifier. With five full-size ISA expansion slots, a 5.25-inch drive bay, and a 275-watt power supply, this Dolch portable is more powerful than many desktop computers.

DUMPING BALLAST

Of course, you don't have to break the bank to go portable. If you can make do with a passive-matrix or dual-scan color display, you can dramatically reduce the cost of multimedia portability. For example, Compaq's Contura Aero subnotebook sells for $2,199. At 3.5 pounds, it's also half the weight of IBM's ThinkPad.

Apple's new PowerBook 520c dual-scan color notebook should sell for around $2,750; compare that to approximately $4,500 for the new PowerBook 540c active-matrix color notebook. (Apple had not finalized prices for the new PowerBook models at press time.) You could save even more by purchasing a model with a passive-matrix monochrome or active-matrix gray-scale display, but then we're no longer talking about multimedia portables.

If you don't own a computer, or if you're thinking of replacing the one you already have, consider going portable. As with any new computer purchase, however, you must weigh your requirements carefully. If you need expansion slots, for example, you're going to pay much more for that functionality in a portable computer than you would in a desktop model. But once you've cut the ties that bind you to a desk, you'll find there's no going back.

EM *associate editor* **Michael Brown** *filed this report from a remote Himalayan village, where he was producing a multimedia fashion show for Tibetan sherpas.*

Going Commercial

Consider a career composing music for television and radio ads.

By Mary Cosola

Want to follow in the song-writing footsteps of Barry Manilow? Start by penning the lyrics to a soft-drink commercial. Trying to crack the Top 40 *and* put food on the table? Sing television and radio jingles. It worked for Luther Vandross and Richard Marx. Or maybe you need a way to pay off all that recording equipment in your living room.

Many musicians deride scoring for advertisements as the ultimate sell out. Sell is the operative word, though not necessarily an expletive. Just because you write a 30-second song praising the benefits of Brand X dog food, doesn't mean you can't write an opera, *too*. The dog food spot can cover your bills while your true musical passion pours elsewhere.

The best part of the job is the flexibility. The increased affordability of high-tech tools makes it possible to record ready-for-broadcast productions in the comfort of your home studio. And because commercial gigs usually have short turn-around times, you can squeeze them in between other jobs. In addition to flexibility, advertising scoring has another advantage over other areas of the music business: It pays; and sometimes it pays quite well.

Q. What do these performers, Luther Vandross and Barry Manilow, have in common? A. They both wrote and sang jingles while starting out in the music business.

HAWKING YOUR GOODS

Let's say you've decided to pursue scoring for commercials. Before you even consider approaching a prospective client about work, do your homework. Scrutinize television and radio ads. Don't just look for what you like or don't like, listen for prevalent styles and attention-getting scores. Also, take note of the musical structures in commercials: how long the average intro is, when the music fades for voice overs, and so on.

Once you think you have a feel for what works and what doesn't, try your hand at writing a few sample commercials. You'll need these samples to put together a demo. That's right, a demo. This is just like shopping for a record deal, unpleasant legwork and all.

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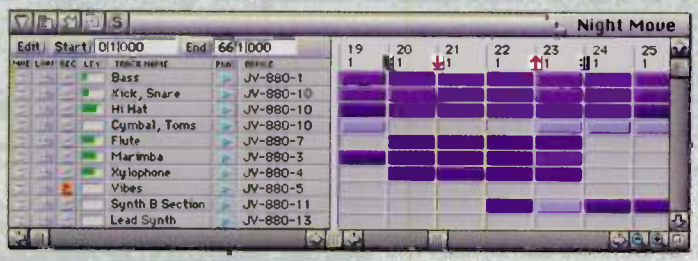

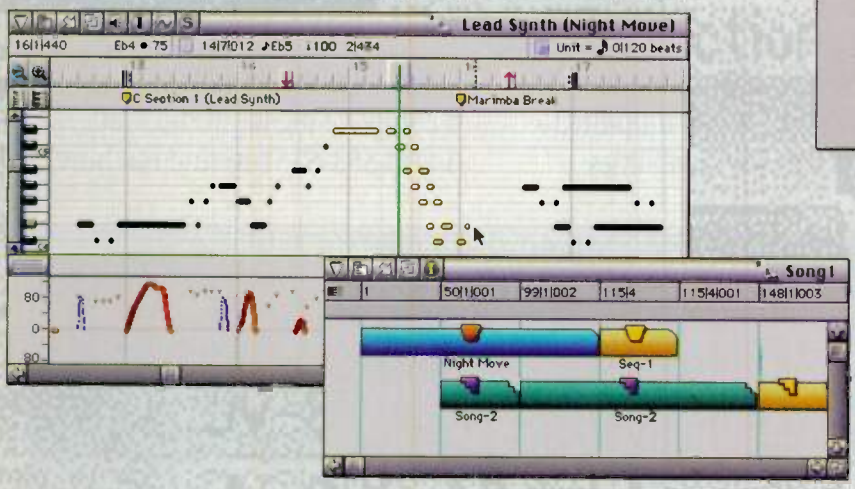

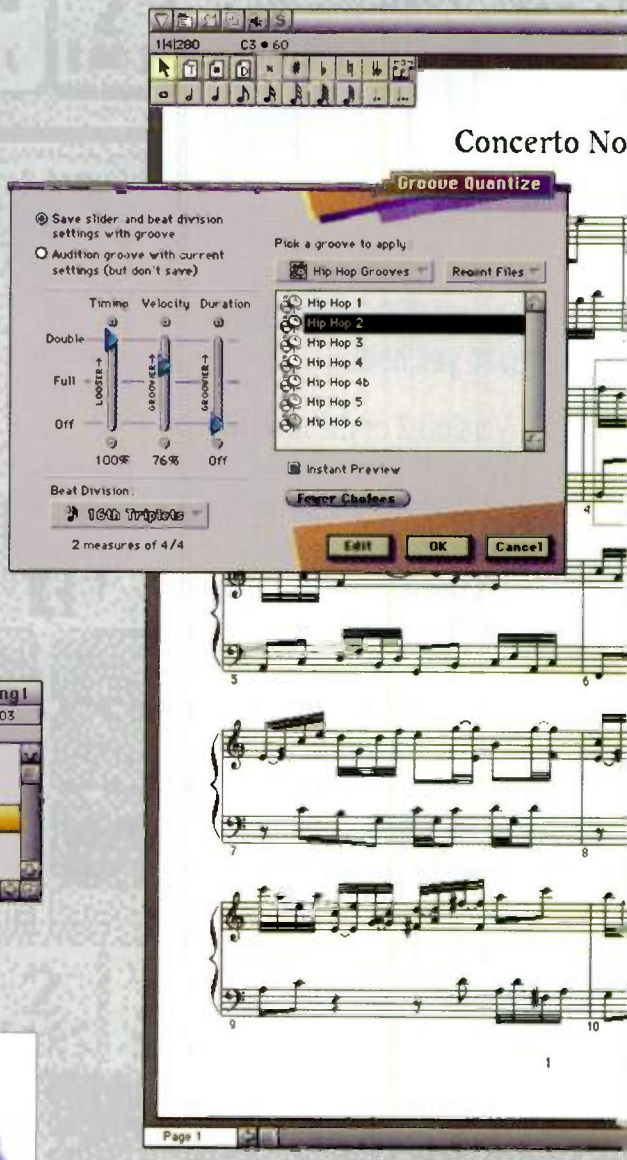

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your demo tape to local ad execs, businesses, and jingle production houses. All the usual rules of self-promotion apply: Include a concise, typewritten cover letter; contact numbers; and any pertinent musical credits. Don't forget follow-up letters and phone calls, but remember that harassing people seldom works.

If you do encounter rejection, ask for a critique of your work so you can fine tune it for further submissions. Also, if finding work directly from ad agencies or businesses proves a dead end, a production house might be willing to bring you in to help out on an as-needed basis.

But let's face it, starting out cold is the pits. The best way to drum up business is through contacts in your local music community. You still need the demo and the polite but firm self-promotional skills, but any connection is better than none. In fact, all of the professionals I interviewed said that word of mouth is the best way to get work.

WHAT TO EXPECT

Getting clients is only the tip of the iceberg; you still have to deliver the goods. Your first reality check is that your musical chops are often secondary to your people skills. "There are so many variables you have to put in the equation that have nothing to do with music," says Bob Christianson of World Coast Music in New York City. "You may have ten clients in a room wondering if they'll have a job tomorrow if they mess up the spot you're doing for them today."

The first application of those all-important people skills is asking the right questions of your client. Again, if you've done your homework, you'll have a point of reference when your client starts naming commercials he or she likes. More often than not, a client is not musically articulate. It's your job to help them arrive at the sound they're looking for.

"When clients have absolutely no idea what they want I'll do a 'needle drop' session, meaning I play small bits of about twenty different spots and see which are close to the sound they want," says Christianson. From there, he questions the client about what exactly he or she liked in those needle-drop spots. This trial-and-error method is not unusual.

On the other hand, some ad execs know exactly what they are looking for, or so they think. "I tend to get people who contact me because they are tired of ads that sound like ads; they want ads that sound like records," says independent producer Scott Mathews. "But in the course of putting the ad together, they inevitably start asking for elements that make it sound just like an ad. It's just a reality of the business."

Composer Bob Christianson's room at World Coast Studios in New York City, where he has produced Clio award winners for Burger King, HBO, and Philips lightbulbs; arranged and produced the CBS 1992 and 1994 Winter Olympic themes; and composed the HBO "Comedy Hour" theme.

The composer can be brought into the ad-creation process at any point. Of course, most composers prefer to be consulted at the outset, but that's not usually the case. "If the song is the basis of the ad, you're brought in first. But most of the time, you're at the bottom of the food chain," comments Christianson. "After everything else is done, they are over budget, they have run out of money and time, and the ad has to be on the air two days later, then they come to you to do the music."

In short, be ready for anything. Sound designer Stephen Dewey of Machine Head, in Venice, California, stresses that not only do you need to ask the right questions, you must have the right answers for your client. "Sometimes I

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look at the ad footage and realize that sound design is all wrong for the ad," says Dewey. "I have to be honest and tell the client that sound design won't work, and we should do a musical score for them."

The turn-around time for commercials is amazing. In the span of two to three days, you'll meet with your client, do a quick demo to make sure you're on the right track, send it back to the client for feedback, make your changes, record the final piece, send it back to your client, make the final tweaks, master it, watch it synched to the visuals with voice-overs, make any tweaks necessitated by those elements, and ship it off. Entertain no delusions of this as a quick 'n' easy way to make money: It's an incredibly difficult job.

IT'S A WRAP

Even though your job as composer is difficult, a large part of that job is putting your client at ease. "The composer has to be fluent in words and music. That's a crucial strength. It's also the reason people will come back to you," notes Jim Harrington of Musical Infinities, a music-production facility in San Francisco. "Once communication is established between composer and client, the client doesn't want to start at square one with someone else."

Christianson sounds the same note, "Clients will always come back to you if you made their life easier, especially if you made them look good."

Here are some final bits of advice: Always get the contract and money matters settled up front, before you record a single note. This piece of common sense applies to any business dealing, musical or otherwise. Once everyone knows where they stand, the creative process moves much more smoothly. Also, you have to keep promoting yourself. The biggest names in the business have reels, CDs, and brochures detailing their work, along with publicists to send them out and follow up.

And when it comes to final advice from the pros, Harrington says it best, "You must be an excellent, versatile musican. If you don't have the chops, you're dead."

Senior Assistant Editor **Mary Cosola** *took it as a sure sign of the apocalypse when Nike used the Beatles' "Revolution" to promote fitness shoes.*

RECORDING MUSICIAN

Recording A Cappella Groups

Explore new sonic territories with the glory of the human voice.

By Buddy Saleman

As modular digital multitracks, digital-audio sequencers, and other high-tech wonders duke it out for supremacy in a rapidly changing audio world, I find relief in the oasis known as *a cappella*. This musical style is a wonderful antidote for too much technology. A cappella groups use the unadorned purity of the human voice to construct entire songs and soundscapes. Synthesizers need not apply.

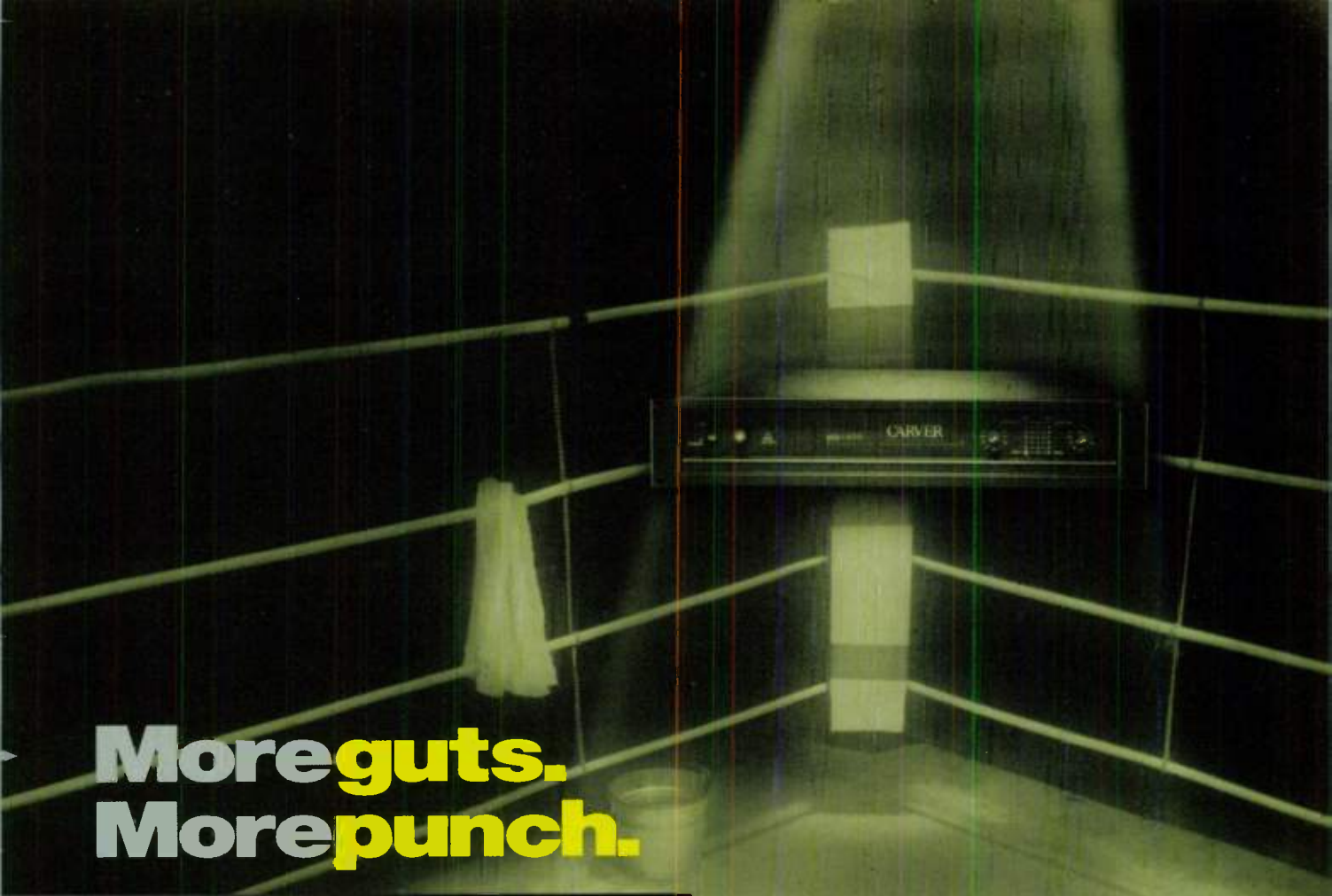
Although the natural beauty of a cappella singing is inspiring, recordists may find the challenge of documenting something so simple and evocative rather daunting. Although a cappella productions require vocal nuances to be recorded with clarity and sensitivity, you don't need a professional studio and a million-dollar microphone collection to get results. You *can* make great a cappella recordings in a home or project studio. All you need is patience, creativity, and a couple of good mics.

Chart-topping a cappella groups such as Take 6 have helped bring vocal music into the popular mainstream.

ALL TOGETHER NOW

Reference tracks are critical for a cappella recording because the singer has no band to follow. The "drummer" is a click track recorded to tape, hard disk, or sequencer. To be safe, always track a longer duration of click reference than is needed. Next, record a simplified keyboard version of the bass line as a pitch reference. Because this part helps the bass voice find his or her pitch, avoid synth patches that produce complex overtones; simple piano sounds are usually the best choice.

To assist the melody and harmony vocalists, a full chord at the beginning of each bar or musical phrase is sufficient. Make sure all reference parts are tight with the click track, or rhythmic fluctuations will compromise the work. Lastly, add a spoken guide track. This "stress reducer" should include the initial count off for the song, critical song location points (verse 2, bridge, final chorus, etc.), and any special directions ("hold chord for two bars, then decrescendo for two beats," and so on).



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ENSEMBLE MIKING

Once the guide tracks are recorded, I start working with the backing vocals. Individual miking of each member—whether the performers record their parts one after another, or simultaneously in different rooms—is the cleanest way to record, because there is no signal bleed from the other singers. However, most a cappella groups are used to performing as a unit, so breaking up the singers often destroys the group vibe. I consider the quality of a singer's performance more critical than pristine sound, so I typically opt for *ensemble* miking. This method allows the singers to relate to each other and hopefully generate some of the energy of a live show.

One of my favorite ensemble miking techniques requires a pair of matched mics, placed approximately head height in an XY pattern. The singers are arranged in a semicircle with the mics pointed right at them (see **Fig. 1**). Professional-quality condenser mics such as AKG's C414 and Neumann's TLM 193 produce the best results, but I've recorded good tracks with low-cost dynamic mics. Stereo sound reproduction is maintained by assigning the two mics to two separate tracks, panned hard left and right during playback and mixdown.

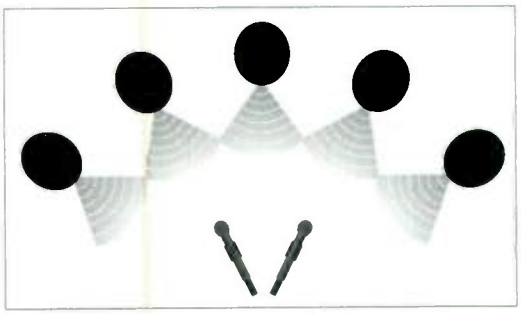

FIG. 1: A sensual blend is captured with a spaced pair (shown) or XY miking pattern.

Because the voices blend with the room environment before they hit the mics, a nice airy quality is captured by using this technique. Experiment with the distance between the mics and singers until you get the right balance of ambient and source sounds. Vocal dynamics can be tightened up by recording with a stereo (or dual) compressor inline, set to a 2:1 ratio at a threshold of -5 dB.

A variation of this technique involves grouping the singers around a single condenser mic. The mic's polar pattern is set to omnidirectional, and the vocalists are moved back and forth until a pleasing balance is achieved. To get a thick, sensual sound, I record two separate passes of a vocal performance—effectively doubling the part—and pan the tracks hard left and right. A more intense effect is gained by heavily compressing the signals during recording. I typically squash the vocals with a ratio of 5:1 and a threshold of -20 dB.

For a hybrid approach to ensemble miking, use separate mics for each singer. Position the vocalists in a circle, so that all the group members can see each other for phrasing cues (see **Fig. 2**). This technique allows the recordist to signal process and EQ each voice individually, record each voice onto a separate track (if you have a vast modular digital multitrack system), or submix the individual inputs to a stereo or mono perspective.

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Mic choices should be determined by the vocal parts. On midlevel sessions, I typically use Electro-Voice RE20s on basses, AKG C414s on tenors, and Audio-Technica AT4033s on sopranos. If you have an expensive mic collection at your disposal, use the best mics available. Listen critically to ensure that the mics you audition accentuate the quality of each voice. The hybrid method produces a more "up front" and intimate quality than XY (stereo) miking.

Signal bleed is unavoidable with ensemble miking. But don't panic if you hear a ghostly echo of Tenor 1 in Soprano 2's microphone. In fact, signal bleed—from other singers and room acoustics—is a big reason for the rich sound captured by ensemble miking. Signal bleed is only detrimental when a vocalist is having pitch problems, because the bad notes may remain audible on the tracks of the other singers. If you're submixing, poor performances definitely compromise the group sound. In these instances, it's often best to have the group sing the parts over and hope the offenders find their pitch.

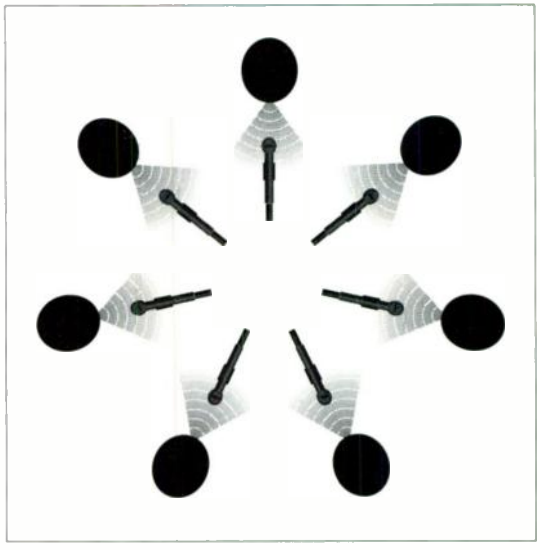

FIG. 2: If you have the microphones available, more control over individual sounds can be gained by miking each vocalist separately.

SOLOS

Once the backing tracks are down, you can let the soloists loose. I don't like stifling a singer's performance by constantly repairing each section of single vocal track, so I usually record four complete takes of a song. When I have four good performances available, I pick and choose between them to assemble the final vocal track (see "Recording Musician: Composite Vocal Tracks" in the April 1994 **EM**).

It's essential that a cappella vocals sound natural, so I seldom use EQ or signal processing. If compression is necessary, a light setting of a 2:1 ratio at a threshold of -10 dB should tame dynamics without sounding squashed. Any professional-quality, large-diaphragm condenser mic is fine for recording lead vocals—my favorite is AKG's C414—but make sure the mic reproduces everything the singer gives you. Some vocalists sound better recorded through dynamic mics. Trust your ears.

FOOLING AROUND

Many a cappella groups "fake" rhythm tracks by having the vocalists emulate instrument sounds. Mouth drums are common, but some vocalists also sing guitar lines (including *Shaft*-inspired wah-wah effects), bass lines, and keyboard pads. Recordists can enhance this fakery with microphone placement and signal processing. The following recording tricks have been successful on several of the a cappella albums I've produced.

Percussion. Put the vocalist in a bright-sounding room (a small bathroom, tiled kitchen, etc.) and position a condenser mic very close to the singer's mouth. I typically use an AKG C414 set to a hypercardioid pattern. Because you're close-miking, it's a good idea to use a wind screen to guard against nasty plosives. Heavy compression—a 10:1 ratio at a threshold of -10 dB—accentuates the sonic impact, and running an expander in tandem helps rid the signal of lip smacks and other noises. Use EQ as needed. I often boost 100 Hz to pump up kick-drum emulations and 3 to 5 kHz to intensify vocalized snare cracks.

If I really want to get tricky, I'll also position a Shure SM57 a bit off axis from the C414. The SM57 is used to get even more of an aggressive sound, so I'll cut all the low end from the signal to get more of the crack of the snare. (If you use this method, be sure to listen for phase cancellation between the two mics.) Finally, I'll position a pair of

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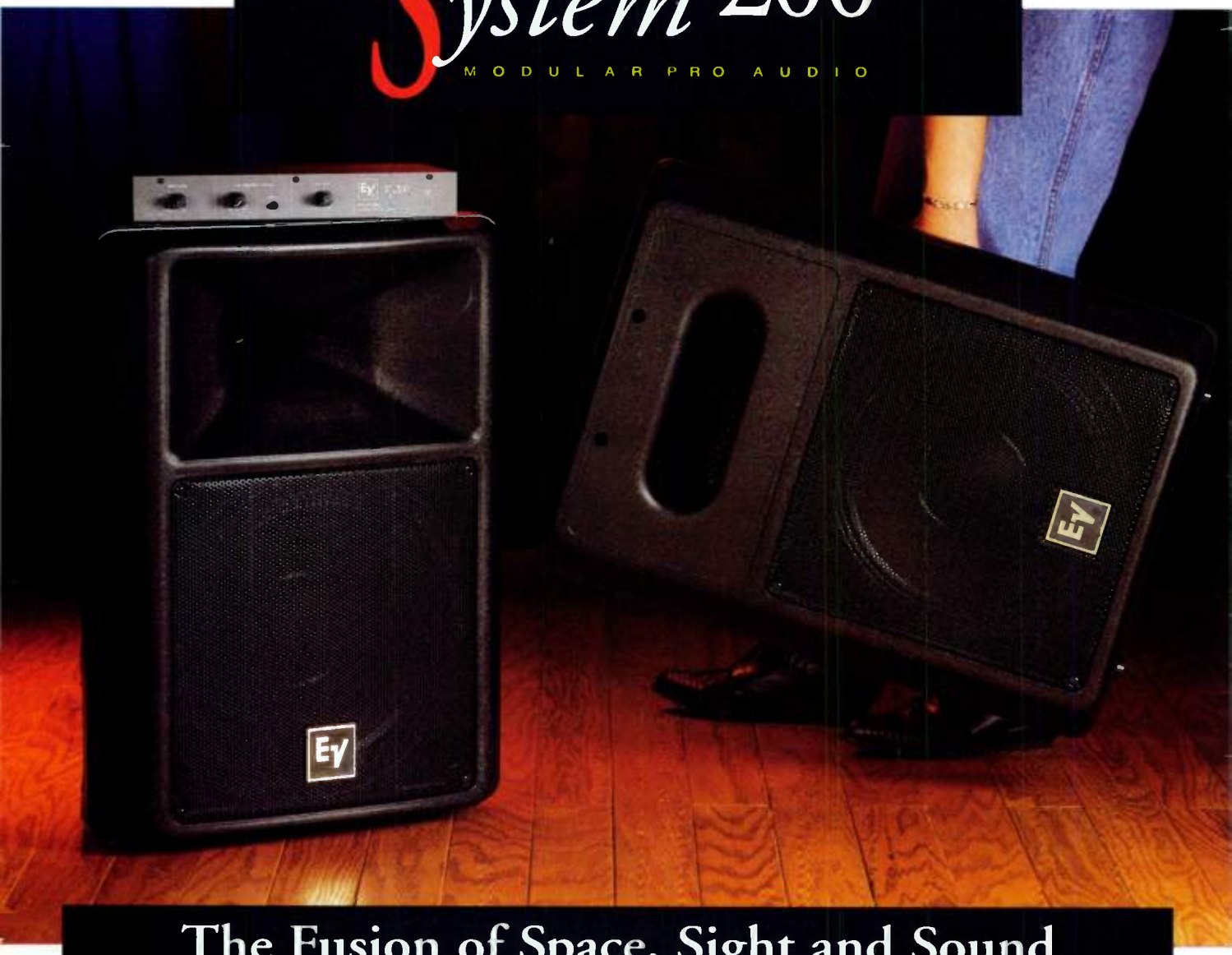

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matched condenser mics over the singer's head, approximately 6 to 8 feet high, to capture the natural room ambience. Depending on how brave I am, I'll either assign the four mics to four separate tracks, or submix the inputs to two tracks for a stereo perspective.

Electric bass. My favorite vocal bass sound was achieved using an AKG C414—placed close to the singer's mouth with just a foam pop filter, no wind screen—set to the hypercardioid pattern and routed through an old Altec tube preamp. The tubes really warmed up the sound. The signal was also patched into a dbx Model 296 Spectral Enhancer to clarify the bass frequencies and a compressor set to a 3:1 ratio with a threshold of -10 dB.

Guitar. Faking electric guitars is tough, because few things sound like a Les Paul plugged into a Marshall amplifier. (Except, of course, a Les Paul and a Marshall, or an amp/speaker emulator such as Tech 21's SansAmp.) My best results have come from willfully destroying the quality of the human voice. I use a cheap dynamic mic (Radio Shack has some beauties) and route the signal through a tube preamp *and* a distortion pedal. My stomp box of choice is ProCo's RATT. But we're not done yet! I also run the signal into a MESA/Boogie or Marshall amplifier. The amp is miked with a Shure SM57, and I compress the tar out of the signal: a ratio of 10:1 with a threshold of -20 dB. If the singer is on the money, the effect is very convincing.

FADE OUT

The simple beauty of a cappella is that you hear singers and a song, and nothing else. No kitchen-sink sonic treatments, wild guitar solos, or blaring horn sections. And I'm always amazed at how evocative and versatile the human voice can be. Sensitive recordists should strive to maintain this purity by remaining true to the spirit of the voice. In other words, don't allow multitrack mania to rage unchecked. If a part sounds good, don't automatically double or triple it. Don't stack vocal sections if one track is enough. Use your ears and heart to direct your instincts and, if the singers are good, you should produce recordings that send chills down your spine.

Buddy Saleman *is an independent producer and head engineer at Sound & Vision Studios in San Francisco.*

Reviews

Yamaha VL1 Virtual Acoustic Synthesizer

By Scott Wilkinson

Give me this synth, or give me death!

As I peered through a slit in the curtain, I could see several agents slowly advancing on the house, breath controllers drawn and ready. They must be from Yamaha, here to retrieve the VL1 I've been reviewing. When they asked me to return the unit after the review was finished, I told them they'd have to pry it from my cold, dead fingers; I guess they took me at my word.

I took careful aim with a P.A. speaker as I dialed up a bagpipe sound. I figured if bagpipers walk around while they play to get away from the noise, maybe these guys would cut and run after hearing me play "Amazing Grace" on the VL1. The emulation is so good, they might even think I have a real bagpipe in here, which would send almost anyone scurrying for cover.

The Yamaha VL1 is the world's first commercial physical-modeling synthesizer. It's intended to play lead, solo, and bass parts with a maximum polyphony of two notes.

As you might surmise by now, I'm in love. The VL1 is the most amazing synthesizer I've ever played. Granted, it's mondo expensive and monophonic, to boot. It's not without a few minor flaws, either; after all, there is no such thing as a perfect synth. But for a wind-controller player like myself, it is far and away the best thing since sliced reeds.

Keyboard players ought to love it, too, thanks to the Yamaha breath controller. Unlike other synths, though, you can't take it out of the box and start wailing; you must learn to play a new instrument. This learning curve is relatively steep, because most keyboard players are not used to coordinating breath articulations with notes played on the keyboard. And programming it takes us all back to square one. However, it's well worth the effort.

FIRST GLANCE

As a monophonic lead and bass synth, the VL1 harkens back to the Minimoog, being similar in size and application. Its 49 unweighted keys are sensitive to Velocity and Aftertouch (MIDI Channel Pressure). The front panel is deceptively simple, with lovely wood paneling. (Yamaha also makes the wood trim for Lexus cars.) A 240 × 64, graphic LCD display includes a dedicated contrast knob, which is handy, and eight "soft" buttons that perform various tasks indicated in the display.

The standard pitch and mod wheels are joined by a second mod wheel, which is center-detented. The pitch wheel and mod wheel 1 are permanently assigned to send Pitch Bend and Modulation messages, while mod wheel 2 can be assigned to any Control Change message. The Octave Up/Down buttons above the wheels affect the keyboard only, not incoming MIDI notes. Below the wheels are the headphone output and breath-controller input; the VL1 comes with Yamaha's new BC2 breath controller.

To the left of the LCD, the volume slider is accompanied by two control sliders, each of which can be assigned to a wide variety of internal parameters. Moving these sliders also sends the appropriate System Exclusive messages to the MIDI Out for recording

into a sequencer. Three mode buttons and two buttons labeled Copy and Store are located above the sliders. To the right of the LCD are the cursor-navigation buttons, Enter/Exit buttons, and Increment/Decrement buttons, located directly below an infinitely rotating, detented data wheel. The Bank/Voice select buttons do double duty in Edit mode, as indicated by the purple labels.

The rear panel includes MIDI In/Out/Thru ports, two audio outputs, two footswitch inputs, and two continuous foot-controller inputs; the VL1 comes with one FC7 foot controller. Foot-controller 1 is permanently assigned to MIDI Foot Controller (Control Change 4) messages, while foot-controller 2 and footswitches 1 and 2 are assignable to any Control Change message. The footswitches can also be assigned to step through the Voices in memory, sending sequential Program Change messages to the MIDI Out at the same time.

The VL1 holds 128 Voices in battery-backed RAM, arranged in eight Banks of sixteen Voices each. (Voices are the basic playable entities in the VL1.) In the display, each Voice is identified with a Bank letter (A through H) and Voice number (1 through 16), as well as the equivalent Program Change number (1 through 128). There is no RAM card option.

A 3.5-inch, DOS-compatible, high-density, floppy-disk drive is located on the left side of the VL1. You can save and load individual Voices, Banks, System files, and "All" files that contain everything in memory. An All file consumes less than 300 KB of disk space. When loading and saving single Voices to disk, you can display them by number or alphabetically by name, which is way cool.

The VL1 comes with a disk of 128 Factory Voices, 128 Customer Voices (which are basically the same as the Factory Voices, but with a few tweaks to the controller settings), and five Example Voices (which also are variations of the Factory Voices). You can also get a set of Factory Voices optimized for wind controllers free of charge. Additional optional Banks are available for a projected cost of—get this—$129! That's about eight bucks per Voice. You might feel outraged at this, especially compared with sound sets for other synths. On the other hand, each Voice is equivalent to a real acoustic instrument, for which eight bucks is a bargain. It also takes a lot more time and effort than usual to create a viable VL1 Voice. If you can afford the VL1 in the first place, you can probably afford the optional Voices.

VIRTUAL ACOUSTICS

The VL1 uses an entirely new sound-generation technology called *Virtual Acoustic Synthesis* (VAS), which is Yamaha's version of physical-modeling synthesis. In this process, a mathematical description, or *model*, of the behavior of acoustic instruments is programmed into a digital signal processor (DSP), which churns out a stream of numbers based on the model and real-time performance information, such as what note is played, what controllers are used, etc. The stream of numbers is then converted into an analog signal, which corresponds to the sound of the acoustic instrument being modeled. (For more on VAS and physical-modeling synthesis, see "Model Music" in the February 1994 **EM**.)

The models in the VL1 are derived from wind and bowed-string instruments, in which a continuous stream of energy maintains an acoustic oscillation. Yamaha calls this *self-oscillating VAS*, or S/VAS. (The impending VP1 synth is based on impulse-driven instruments, such as percussion and piano; Yamaha calls this *free-oscillating VAS*, or F/VAS.) Surprisingly, the VL1 model manages to emulate plucked basses and guitars in addition to blown and bowed instruments.

Because the basic VL1 model is based on instruments that require a continuous stream of energy, most of the Voices don't make a sound if you simply play the keyboard. They require a breath controller, which provides a stream of Control Change values that represent the player's breath pressure or bow velocity over time. The role of the breath controller can be performed by other physical controllers, such as a mod wheel or foot controller, but a real breath controller provides the most accurate and realistic results. However, keyboard players must learn to coordinate their keyboard skills with breath articulations, which makes the VL1 more difficult to play than most synthesizers. Keyboard players who sing must learn to coordinate their keyboard performance, multiple controllers, and vocals.

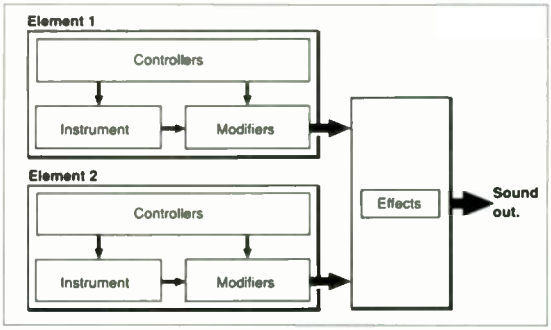

FIG. 1: A VL1 Voice consists of one or two Elements and an effects section. Each element includes an Instrument model, five harmonic Modifiers, and twelve Virtual Controllers that modulate the Instrument and Modifiers. (Courtesy Yamaha Corporation.)

Each Voice is based on a particular physical model, called an *Instrument*, which emulates a driver (mouthpiece or bow) attached to a pipe or string. Some of the synthesizer's most interesting Instruments are hybrids, such as Breath Bow and Floboe, which combine different types of drivers and pipes or strings in physically impossible configurations.

Creating virtual Instruments requires a deep knowledge of acoustical physics, and it's easy to create an Instrument that sounds bad, so Yamaha doesn't let users access this level of the VL1. However, there is a plethora of parameters you can alter, with potentially drastic results.

Product Summary

PRODUCT:
VL1 Virtual Acoustic Synthesizer
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MODIFIERS

The signal from an Instrument is sent through a series of five Modifiers, all of which include a "wet/dry" control to balance between the modified signal and the original Instrument signal. The Modifiers are user-programmable, letting you change the timbre of the sound dramatically. The first two Modifiers in the chain can also be controlled in real time, providing additional expressive capability.

The first Modifier is a Harmonic Enhancer, in which an FM modulator/carrier pair is mixed with the Instrument signal. The waveform used by the modulator and carrier is selected from a list of several sources, such as the beating of the "reed" against the "mouthpiece" or the varying area between the reed and the mouthpiece (called the "slit"). The depth (wet/dry balance) can be dynamically controlled with a physical controller (e.g., mod wheel or breath controller). The Harmonic Enhancer is capable of some serious tonal tweaks; I was able to change a sax sound into a blues harmonica by altering only a couple of parameters.

The Dynamic Filter is a resonant filter capable of highpass, lowpass, bandpass, or band-reject operation. Cutoff frequency is dynamically controllable by any physical controller. The Frequency Equalizer provides five bands of fully parametric EQ and two shelving filters (highpass and lowpass) with key-scalable cutoff frequency.

The last two Modifiers are the Impulse Expander, which consists of a frequency-dependent delay, and the Resonator, which consists of five parallel delays. These work together to emulate the resonant cavity or sound box of an acoustic instrument. According to the manual, the Impulse Expander is more suited to metallic resonances, while the Resonator is better for woody resonances. However, these Modifiers do little to the sound of brass and sax Voices. The manual says the Impulse Expander can also be used to simulate ambient environments, but I found the Resonator did this more effectively.

VIRTUAL CONTROLLERS

The Instrument and the first two Modifiers are controlled in real time with physical controllers, which include the first 119 Control Change messages, Aftertouch, Pitch Bend, Velocity, and two special items: Breath Attack and Touch EG (discussed shortly). In the case of Instruments, these physical controllers are assigned to twelve Virtual Controllers, which correspond to various playing techniques in acoustic instruments. Most of the Virtual Controllers include 33 response curves, which makes it easy to tailor the response of the Voice to your particular playing style.

Pressure is one of the most obvious Virtual Controllers, corresponding to the amount of breath pressure or bow velocity in an acoustic instrument, which affects both volume and timbre. This is not the MIDI Channel Pressure message, which Yamaha calls Aftertouch in the VL1. Breath Controller is usually assigned to Pressure.

Embouchure corresponds to the tightness of the lips against the reed, against each other in a brass mouthpiece, or the force of the bow against a string. Changing the Embouchure in most wind and brass Voices causes the

sound to jump resonant modes up and down the harmonic series, which is cool in the extreme. Mod wheel 2 normally controls Embouchure, both being assigned to Control Change 13. However, I reassigned Breath Controller to Embouchure on some flute Voices, which corresponds to the way acoustic flutes work: You blow harder to jump modes. Pitch Bend also works well in this regard. Unfortunately, Embouchure has no adjustable response curve, which made it more difficult to achieve the specific response I was after.

Pitch corresponds to small pitch changes; Pitch Bend is usually assigned to this Virtual Controller. You can also set different ranges for bending up and down. Some Voices, such as the saxes, have Pitch Bend assigned to Pitch and Embouchure, which is very effective. Vibrato is a highly sophisticated LFO that modulates Embouchure and Pitch and includes variable randomness and key-scalable delay, onset rate, speed, and depth. This produces a realistic vibrato that is more pronounced than an actual breath or jaw vibrato. Mod wheel 1 is typically assigned to Vibrato, although wind-controller players will probably want to reassign it to foot controller 1.

Tonguing corresponds to a sax technique in which the player holds their tongue against the reed to alter the timbre; this can also be effective on other types of Voices. Amplitude controls the volume of a Voice without affecting the timbre. Scream corresponds to chaotic oscillation in an acoustic instrument, which sax and brass players use to great effect. Breath Noise adds this critical sound component in addition to any breath noise in the model itself. Growl applies an LFO to Pressure, which emulates flutter-tonguing and other effects. Throat Formant is used to emulate the changing resonant characteristics of the player's lungs, throat, and mouth.

Damping emulates the effect of energy loss within the body of a wind instrument, or in a string due to air friction, affecting both pitch and timbre. Absorption corresponds to the characteristic high-frequency loss at the end of an air column or string.

Breath Attack and Touch EG are unique "physical controllers" intended primarily to influence the attack portion of the sound. Breath Attack affects the Virtual Controller to which it is assigned when the *change* in Breath Controller value exceeds a user-specified amount. The duration of this effect is user-specified from 5 ms to 1.24 seconds. Touch EG applies Aftertouch to the Virtual Controller 5 ms to 1.24 seconds after each note begins; during this initial time, Velocity affects the Controller. Both these controllers help fine-tune note attacks to respond like an acoustic instrument.

Five Controller Envelopes—Pressure, Embouchure & Pitch, Vibrato, Growl, and Amplitude & Filter—provide additional control over the appropriate Virtual Controllers. The Amplitude & Filter envelope can be used like a traditional EG on bass and synth-like Voices; the same envelope is applied to both Amplitude and the Dynamic Filter, with independently programmable depths.

ELEMENTS AND EFFECTS

An Instrument, with its associated Modifier settings and controller assignments, constitutes an Element. A Voice consists of one or two Elements and the common effects settings (see **Fig. 1**). Most Voices include one Element, although two Elements are used in some Voices to produce the main sound and breath noise, low and high pitch ranges, and split and layered sounds. The VL1 can play one or two notes at a time, depending on several factors. This low polyphony is understandable when you consider that the computational requirements of physical modeling are enormous. To give you some idea of how enormous, the VL1 uses about 10 MB of RAM to execute the models in real time.

There are three types of stereo effects, which can be applied to one or both Elements in a Voice. The modulation effects include a flanger, pitch shifter, and distortion. The feedback delays include mono; independent delays for the left and right channels; and independent delays for left, right, and center (left and right equally). There's even a handy delay-time calculator; give it a tempo and note length, and it tells you the corresponding delay time! The reverbs include two Halls, two Rooms, Plate, Space, and Reverse.

The signal first passes through the modulation effect. The following feedback delay and reverb can be configured in series or parallel. One effect

from each type is available for each Voice. All effects have a full complement of parameters, some of which can be controlled in real time by assigning a physical controller or control slider. As far as the quality of the effects is concerned, they sound great.

Most of the Voices themselves are absolutely exquisite. The saxes are superb, the flutes are fantastic, the basses are bodacious, and the double reeds are delicious; you can almost feel them vibrating in your mouth and under your fingers. If you blow very softly, you hear nothing but breath noise from the model. As you slowly increase your breath pressure, you hear the model begin to oscillate. In some voices, the tone is a bit weak and flat at first, quickly becoming strong and steady throughout most of the Breath Controller range, just like an acoustic instrument.

I used a Yamaha WX11 wind controller most of the time, to which the Voices respond beautifully. I also tried the keyboard with breath controller, which works equally well. The emulative Voices sound best in the natural range of their acoustic counterparts. However, the natural ranges of the included Voices are not preprogrammed in the VL1. You must do this manually if you want realistic note ranges.

Among the few Voices I like less are the brasses, which sound too "synthlike" for my taste. I play brass instruments professionally, so I'm a particularly harsh critic of these sounds. I tried to improve them with the Impulse Expander, which is not applied in the factory settings, but it had little effect. Nevertheless, these sounds still respond better to breath control than any other synth I've played.

USER INTERFACE

The VL1 is well organized, providing three modes: Play, Edit, and Utility. As you might expect, Play mode lets you select and play Voices, while Edit mode lets you edit Voices. Utility mode provides access to global system parameters, SysEx bulk dumps, disk operations, a Voice Recall function, and an automatic demo of the instrument. Voice Recall brings back the last edited Voice, even if you didn't save it before selecting another Voice.

In Play mode, you can view the current Voice in large letters, or all sixteen Voices in the current Bank in small letters. Unfortunately, the display

responds erratically or freezes altogether while you scroll through Voices too quickly, which is disconcerting. This also happens when quickly scrolling through parameter values in Edit mode.

Play mode also lets you display a list of Virtual Controllers and the physical controllers assigned to them, which is very handy. You can also display the control-slider assignments, default values, and current position. You can jump to the appropriate edit screen simply by placing the cursor on the desired controller and pressing Edit, which makes it easy to edit these assignments and controller parameters.

In Edit mode, there are often several ways to get to a certain page, which can be confusing. However, this usually follows a logical path once you get used to it. To help you remember your way, a path name through the various editing levels to the current page appears at the top of the display, sort of like DOS path names. As mentioned earlier, the Bank/Voice select buttons do double duty in Edit mode, turning Elements, effects, and Modifiers on and off, as well as selecting Elements for editing.

The documentation consists of three parts: *Getting Started* (64 pages), *Feature Reference* (190 pages), and *Voice List/MIDI Data Format* (15 pages). This is some of the best documentation I've seen from Yamaha, although it provides inadequate explanations of some functions. *Getting Started* includes helpful examples and exercises, as well as plenty of pointers to the *Feature Reference*. The *Voice List* reveals all controller assignments and performance notes for the Customer Voices.

PROGRAMMING

Although you can't alter the Instruments on which the Elements are based, you can assign any Element to any Voice. A Mix function lets you adjust the balance of signals from the driver, pipe/string, and a variable tap, which is the signal from any point along the length of the pipe/string. Then you program the Modifiers to change the timbre of the sound and assign physical controllers to Virtual Controllers for expression. A handy Controller Search & Replace function displays all controller assignments in a spreadsheet-like grid, in which you can change the assignments.

There are many ways to program the VL1 to more accurately emulate the response of an acoustic instrument, some of which are mentioned earlier. Crossfade is another response parameter that controls how abruptly the VL1 moves from one note to the next (something I've wanted on synths for years). Interpolate determines the response to Virtual Controllers in the first few milliseconds of each note. Many parameters throughout the instrument are key-scalable, and the key scaling is very sophisticated and flexible.

SHOWDOWN AT THE VL CORRAL

As a lead, solo, and bass instrument, the VL1 is... (*insert your favorite superlative here*). It responds far more like an acoustic instrument than any synth I've ever played. In fact, I spent hours just improvising with various Voices for the sheer joy of it.

On the other hand, five grand is a *lot* of money for a monophonic lead/bass instrument. If you can afford to pay that kind of dough for such an synth, go for it; you won't be disappointed. For the rest of us, I hope and expect that this technology will be made less expensive in future generations of products.

In addition, I hope that future (inexpensive) products can be made polyphonic. If the VL1 were 3- or 4-note polyphonic, you could sequence a horn section. (With all those Control Change messages flying around, the VL1 is quite a memory hog, but today's sequencers run on computers with lots of RAM, so this shouldn't be a problem.) I understand the VP1 will have a maximum polyphony of sixteen notes, but the projected retail price is said to be in the $30,000 to $40,000 range. Yikes!

In the meantime, I'll continue to play the day away on the VL1. Uh oh, what's that? It sounds like the Yamaha agents are coming back. Apparently, my bagpipe solo only drove them off for a little while. This calls for more drastic measures. I know! I'll call up the contrabassoon Voice and play the duet from Stravinsky's *The Rite of Spring*. That ought to scare 'em away for good!

EM *technical editor Scott Wilkinson wrote his physics thesis on the acoustics of wind instruments.*

Howling Dog Power Chords Pro 2.0 (PC)

By Zack Price

This unique rhythm sequencer does much more than its name suggests.

Every once in a while, a program such as Howling Dog Systems' *Power Chords Pro* 2.0 comes along that defies easy description or categorization. Judging by its name, it should come as no surprise that *Power Chords Pro* creates fretted-instrument chord voicings, complete with strumming and picking patterns. However, the *Windows*-based program has also a full-featured drum-rhythm editor, bass-pattern creator, and melody-pattern creator. In addition, it includes a pattern-oriented sequencer that lets you put together and play back all of these parts simultaneously.

The program lets you create chords and chord rhythms. Chords or patterns are dragged to the appropriate "palettes" for storage, and information from the palettes is placed into a Song Window for easy song-construction. The process is straightforward and can be quickly understood by following the onscreen tutorial, which was created using the scripting facility. If you get stuck while working with the program, the online Help files get you back on track right away.

For the keyboard-inclined, *Power Chords Pro* offers a window for creating keyboard chord voicings. These can be exported to the Rhythm Editor, or converted to fretted-instrument voicings. The program imports and exports Standard MIDI Files and is General MIDI- and Roland GS-compatible. And if that isn't enough, it also includes a scripting facility for creating desktop presentations, interactive lessons, and automated playlists.

Because information is created and stored in different editors and palettes, there's a lot of window opening and closing. However, it's easy to move around, because the button bar on the left side of the main screen facilitates fast, flexible window operations.

With all these features, you can see why it's difficult to easily describe or classify *Power Chords Pro*. It's tempting to think of the program as a pumped-up, super rhythm editor. However, it also is an excellent utility sequencer.

INSTRUMENT SETUP

Before creating chords in *Power Chords Pro,* you need to set up the type of Instrument you want to "play." The program's default Instrument is a 6-string guitar with standard tuning (see **Fig. 1**). However, you can create other stringed Instruments, such as banjo, mandolin, bouzouki, and ukulele. You can also specify alternate tunings for the Instruments (such as a guitar tuned to open G), or tune them as if a capo is set at a particular fret. In addition, each string can be set to its own MIDI channel and patch. Each Instrument setup can be saved to its own file for easy recall, and you can designate your own default Instrument.

Instruments are limited to a minimum of two strings and four frets and a maximum of twelve strings and 24 frets. Although only one Instrument at a time can be used in the chord-creation

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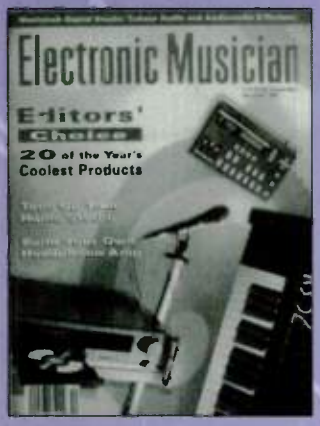

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and playing process, with a little imagination, it's easy to make customized "double" Instruments. For instance, in one song, I wanted to "play" a guitar and mandolin together. To do that, I created a 10-stringed Instrument, with standard guitar tuning on the first six strings and mandolin tuning on the last four. The guitar strings were set to one MIDI channel and patch number, and the mandolin strings were set to a different MIDI channel and patch number.

DRUM SETUP

Power Chords Pro also is a drum-rhythm editor, so you will need to set up a drum kit. This is a 2-part process. First, a drum list is created by naming the different drum sounds and matching them to the appropriate MIDI note numbers. Lists can include a maximum of 74 sounds and can be saved. Because *Power Chords Pro* is GM/GS-compatible, the drum sounds are already defined. Just choose between the General MIDI or Roland GS option to select the proper sound list. In addition, the drum MIDI channel and metronome note should be set (already done for you in GM/GS options). Furthermore, if you have a GM/GS-compatible device, you can choose the desired drum-kit variation for that sound list.

However, some renegades and nonconformists don't always want to use GM/GS sound lists or mapping. For us, the Other option can be used to create a unique sound list, complete with preferred MIDI-channel setting and metronome note. However, reckless souls that cross the bounds of GM/GS conformity should be aware of this option's little quirks. First, remember that the names are initially mapped to the GM/GS note numbers, so make sure you remap the name to the MIDI note number that's right for your setup. (It's easy to do.) You also can input a name. Just make sure the name is unique; if the name already exists somewhere on the sound list, or is mapped elsewhere, it could lead to confusion when trying to set up the drum kits.

After the drum sounds are defined, the next step is to create a drum kit from the list of mapped sounds. Just choose the names of the sounds you want in the kit. Each drum kit can contain 24 different sounds, and each kit can be saved and recalled. This makes it easy to tailor a drum kit to a song without remapping the drum sounds every time.

The only limitation to this feature is that all drum sounds and kits must be on the same MIDI channel. This means you can't trigger sounds on independent channels using the drum-rhythm editor alone. However, the problem is easily solved by triggering the notes from a melody pattern.

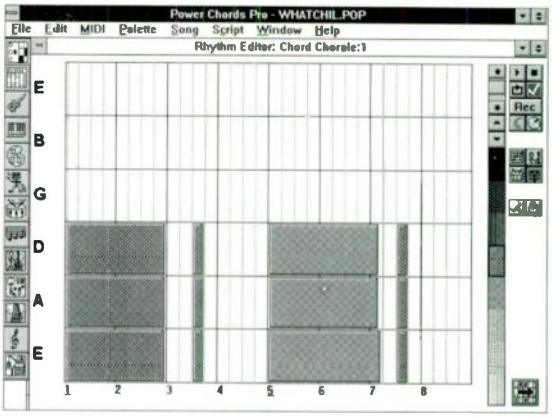

FIG. 2: The Rhythm Editor is actually four editors rolled into one. Each grid has different items in its vertical axis. Shown here is the Chord Rhythm Editor, which displays the name of each Instrument's string tuning.

CHORD CREATION

Chord creation is easy. Just click on the string and fret to place the proper "fingering." Unfretted strings can be left open, or muted by toggling on the nut above the respective string. If you don't know the chord fingering, just use the Chord Request function. Describe the type of chord you need in the Chord dialog box, and *Power Chords Pro* will generate a voicing. If you want a different voicing of the same chord, just click on the Next button.

Real fretted instruments can't always play every note of an extended chord, so some notes must be left out. Which notes get left out depends on such factors as tonality, the type of extended chord played, the desired inversion, etc. In addition, chords can only be realistically formed within a limited span of frets (usually four or five on a guitar), imposing a further restriction on what notes and strings will be played.

Power Chords Pro takes the same two factors into account when creating chord voicings. You can specify how strict the chord construction is (that is, what notes in a chord have to be included in the voicing) and the allowable fret distance. This is a useful feature, particularly when trying to generate chords for instruments such as mandolin and banjo, which require more leeway in voicing and fret-spanning. You can, of course, generate fingerings or voicings that are not typical for the selected Instrument.

Chords are named according to a "most likely" basis. However, because a particular fingering could be identical for three or four different chords, *Power Chords Pro* provides the appropriate alternative names for the same voicing. And if the name for a particular chord isn't available, you can supply one yourself.

Besides creating chord voicings, *Power Chords Pro* also includes a hammer-on function. When engaged, a special note symbol appears in the Instrument's fretboard. Simply move the note to the hammer-on position and click. To determine when the hammer-on will occur, open the Instrument Options dialog box. Hammer-ons can be set to occur on every quarter, eighth, or sixteenth note, or at a specific interval of clock ticks.

Once a chord is created, its icon is

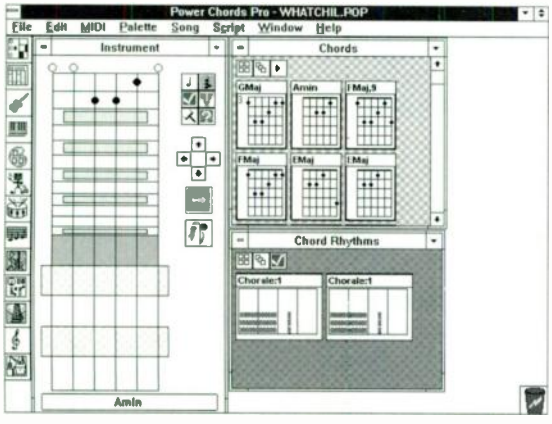

FIG. 1: Chords are created in *Power Chords Pro* by defining and "playing" an Instrument, in this case, a standard 6-string guitar. Once created and stored in a palette, chords can be strummed and picked according to a Chord Rhythm.

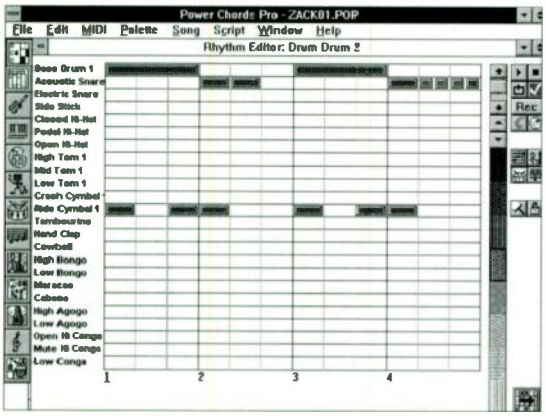

FIG. 3: In the Drum Rhythm Editor, you can see the drum sounds of the current kit. It's a bit reminiscent of the popular rhythm-editing screen on the classic Roland TR-707 drum machine, but is far more powerful.

dragged to the Chord palette, which has room for 128 different chords. This process is repeated for each new chord you create.

THE RHYTHM EDITOR

The Rhythm Editor is really four editors in one, with separate screens for four different rhythm types: chord rhythms, drum patterns, bass patterns, and melody patterns. Each rhythm type is accessed by clicking a button box in the Rhythm Editor window. The four types can be linked in the Rhythm Editor to play and create patterns in context with each other. Once built, each of the rhythm types is dragged to its own palette. Each palette holds 64 different patterns per song.

All four of the Rhythm Editor screens display information in grids, and each rhythm type gets its own, unique grid. For instance, the Chord Rhythm Editor (see **Fig. 2**) is used to create strumming and picking patterns based on the chords created in the Instrument window. Its screen displays the name of each Instrument's string tuning. The pitch you hear is determined by the strings you play, as well as the chord present in the Instrument window. The Drum Rhythm editor (see **Fig. 3**) displays the drum sounds of the current kit, while the Bass Pattern Editor and Melody Pattern editors display the range of notes determined by the pattern setup.

All Rhythm Editors display duration information in the same way. Durations greater than the basic beat division can be drawn in, and the grid's beat divisions can be reset without affecting the length of the notes already in the pattern. In other words, when you change the quantization setting to eighth notes, the existing quarter notes stay quarter notes in placement and duration. That makes it easier to quickly and accurately enter notes and rhythms.

While the grid quantization setting is graphically displayed, there is no corresponding numerical display of the quantization setting. This can be a bit of a problem once past the sixteenth-note division, as it gets harder to easily recognize the quantization setting by sight.

Different blue-colored pattern fills represent Velocity scale values. Velocity values can be precisely altered by clicking and holding on the note, then dragging the mouse up or down to increase or decrease the note's Velocity. Unfortunately, the Velocity scale settings aren't user-changeable, nor is there a numerical display of Velocity values.

Each rhythm type can be recorded and edited using the mouse, the keyboard, and Instrument window. In addition, patterns can be recorded in real time from an external MIDI device. Interestingly, when creating patterns directly with the program's input tools, real-time loop-editing is possible. But when using an external device, real-time recording is done in one pass. However, you can overdub information into previously recorded patterns, so it's not a problem. (Of course, you can change the information later using the mouse or onscreen Instrument.)

Last but not least, notes, lines, and groups of notes can be copied, moved, and deleted. Patterns can be duplicated, deleted, and resized, too. If resized to a shorter length, the "deleted" notes can be recovered by enlarging the pattern or reverting it to its original size. You can also import one rhythm type into another. This feature can be used to create identical rhythmic phrasings from different types of instruments, or as a part duplicator from one Instrument voice to another.

SONG IMPORT

The pattern-duplication and resizing features are particularly powerful when used in conjunction with the Song Import function. With Song Import, you can import a Standard MIDI File that can be used to turn linear tracks into patterns. *Power Chords Pro* displays each track's measures in the SMF as a square. By clicking on a specific square, you can audition that measure; groups of measures can also be selected and auditioned in the same way. Once selected, a measure or group of measures can be dragged to the Rhythm Editor to be turned into a pattern.

The only thing to be aware of when dragging MIDI data to the Rhythm Editor is that *Power Chords Pro* will turn those tracks into default patterns, depending on the original channel of the imported track. Any information on the channel currently in use for drums is assumed to be a Drum Rhythm pattern. All other channels are considered melody patterns. To make sure you get the results you want, set the drum channels for the song to the correct channel in the other sequencing program before exporting the Standard MIDI File.

If you've already imported a file, drag the patterns to the proper palette. Then, when you drag them to the Rhythm Editor, they will already be of the correct type. You can also easily change the type of an existing part. Just change the Rhythm Editor to the pattern type you want, lock it, and drag the pattern from the palette onto the

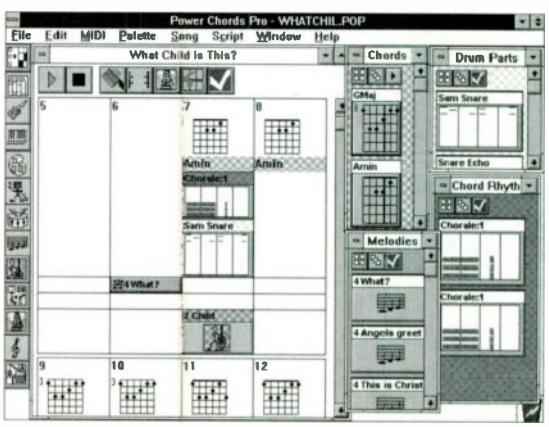

FIG. 4: Songs are created by dragging chords and rhythms from their respective palettes into the measures displayed in the Song Window.

Rhythm Editor. You will now have the information in the desired pattern type, which you can store in its proper palette.

POWER EFFECTS

One of the most interesting features of the Rhythm Editor is the Power Effects processor. There are a variety of effects you can apply to an entire pattern, or to highlighted notes in a pattern. Some effects are familiar, some are more specialized, and some are just plain different.

The familiar effects are Humanize Velocity and Quantize. The first randomly changes Velocity values of selected notes or patterns according to

▼

With a little imagination, it's easy to make customized "double" Instruments.

an adjustable percentage. Quantize simply quantizes notes to the current pattern division.

The more specialized Power Effects include Strum Up, Strum Down, Strum Alternate, and Roll/Pick. The strum effects stagger the attack times of two or more notes occurring on the same beat. The degree of the effect varies according to a user-determined percentage and the selected pitch direction. For example, altering a selected group of notes or pattern with the Strum Up effect set at 50% successively delays the attack time of each higher-pitched note until the highest note is 50% as long as the lowest note. Strum Down differs in that it staggers the attack times of notes from highest to lowest in pitch, while Strum Alternate changes strum direction for each group of notes in a pattern. Using the strum effects can yield interesting results, from gentle, graceful harp plucks to chiming arpeggios. I like it.

The Roll/Pick effect randomizes durations of successive notes to avoid the "machine-gun effect" sometimes heard in rolls created with drum machines. Although the effect does eliminate that

problem, it suffers from a few flaws. First, it only works on one line of successive notes, with no rests in between. Second, it tries to apply this effect to an entire pattern line. However, should you apply this effect to a selected line area or a partially filled line, the program will add a note to fill out the end

Change icon. (Control Change icons are built and stored in a palette in much the same way as chords. They can consist of up to multiple commands for all sixteen channels.)

Songs are limited to a maximum of 256 measures. However, the total song length can be greater, because mea-

measure can have four different chords. Although the division between them can be unequal, chord changes usually depend on Chord Rhythms. Even so, the minimum beat between each chord division is an eighth-note. However, I've yet to find any problem operating within these constraints.

The song-editing functions are prob-

• PIANO MODULES

Like E-mu's Proformance, the MicroPiano has no user memory. However, the Proformance uses hardware knobs that stay on the preset, transposition, and MIDI channel at which you left them. The MicroPiano's only knobs are a Power/Volume control and a data-entry knob. Dedicated buttons put the MicroPiano into edit modes for fine-tuning (±50 cents), transposition (±24 semitones), MIDI channel, effects type, and program. You punch an edit button and dial up the value, which is displayed in a 3-character LED. A decimal point flashes when MIDI data is received.

The lack of memory puts you through a few extra paces. You can send Program Changes and set effects types and depths through MIDI, but all parameters—including MIDI channel—are global and revert to the default settings on power-up. I left the MicroPiano on channel 1 and used a multiport MIDI interface, so I could still use channel 1 on my multitimbral synths. These limitations are minor and can be handled by a good sequencer or master controller.

The absence of memory is a bigger problem with the MicroPiano's three special types of global Configuration settings. In Link mode, the unit can be configured to respond to even-numbered, odd-numbered, or all MIDI notes. This lets you chain two MicroPianos with opposite (odd/even) Link settings to achieve 64-note polyphony. You can also enable and disable Program Change reception and select between four global Velocity curves. The four curves are poorly documented: There is a brief written description in a separate loose sheet, but no graphs. Unfortunately, the MicroPiano can't remember *any* of these fundamental settings. In fairness, although memory is one of the biggest differences between the MicroPiano and the P-55, another big difference is $200 in list price.

The MicroPiano has a modest MIDI implementation. It can play the full range of MIDI note numbers, and it responds to Note On Velocity. Program 1 can be selected by Program Change 0 or 1, which is handy. The unit recognizes MIDI All Notes Off, Volume (Control Change 7), Sustain (64), Sostenuto (66), Soft Pedal (67), Effect Select (83), Effects Depth for Reverb (91), and Effects Depth for

Kurzweil kept the MicroPiano's price low by omitting memory and other trimmings. What you pay for are lots of high-quality, usable sounds and true 32-note polyphony.

Chorus (93) messages. In some programs, it recognizes Modulation (1), mostly for filter cut on the strings and a surprisingly nice, accelerating rotary speaker simulator on the organs.

There are some the things the MicroPiano won't do, but for excellent reasons. It is unitimbral, so it's always in Mode 3 (Omni Off/Poly). It doesn't understand Release Velocity, which is most often used in layering or triggering multistage sounds, such as harpsichord. The unit doesn't support SysEx or MIDI Out, because it has nothing to save or load.

However, the Kurzweil module does not respond to Pitch Bend, either. This proved to be a drag with organ sounds, especially when I wanted to layer the unit with another synth and couldn't bend their pitches together. The MicroPiano does not respond to Pressure (aftertouch), either. This is unfortunate if you're a two-fisted player and want to control organ effects with touch, instead of a wheel. Of course, you can work around it by remapping the MIDI message at your master controller or MIDI patch bay/processor.

P-55 OVERVIEW

Roland has taken a wholly different approach than Kurzweil and E-mu. The rear panel offers MIDI In/Out/Thru and a pair of RCA audio outputs that proclaim the unit's consumer orientation. There is also a stereo pair of RCA audio inputs; the input signal is mixed with the P-55 sound, but you can't adjust the input level. Power is derived from a ridiculously oversized, 9 VDC wall-wart.

The P-55 is programmable, almost to a fault. The unit's front panel sports a power switch, volume knob, and ¼-inch headphone jack. Eight pairs of increment/decrement buttons set the programmable parameters. These buttons have multiple functions when programming; unfortunately, there is no room to indicate these hidden functions on the front panel. This makes the user interface less friendly than I'd like. A Parameter Group button selects among three editing modes.

A set of eight indicators shows which parameter is being edited. An LED lights next to a pair of parameters; which of the two is active depends on the mode. The parameter value is shown in a separate 3-character display.

The unit is 3-part multitimbral, i.e., you can play three Parts simultaneously on different MIDI channels, each of which can be individually muted. Each Part consists of an Instrument and a variety of Part parameters (discussed shortly). Each Instrument can be subdivided into two Sub-Instruments on the same MIDI channel. Each Sub-Instrument consists of one user-selected Tone (sound), which can be layered or split with an assignable split-point. The split feature is nice, but much less useful than it would be if the P-55 offered organ and bass sounds.

In theory, the P-55 is a 28-voice polyphonic device. But two-thirds of the Tones use more than one voice, and some use three or four voices, which proportionately reduces the polyphony. When you use Sub-Instruments, you reduce the polyphony again. If you use the P-55 as a multitimbral sound source, the polyphony is reduced yet again. Sustained notes eat up polyphony, too. What started out as a 28-note polyphonic unit can become a 3-note module in short order. This is not the case with the MicroPiano and Proformance.

Because of this, I couldn't take full advantage of the multitimbral capabilities. Even the Sub-Instruments taxed the polyphony unacceptably, especially with acoustic piano sounds. If the unit had basses, or even guitars, the P-55's approach might be fine. It could even work for the vibraphone and harpsichord patches. But when I layered organs and electric pianos, polyphony was a problem.

Roland has included a Stack (MIDI overflow) mode among the System parameters. Stack mode lets you chain up to eight P-55s, which solves the

polyphony problem, but it's an expensive solution.

P-55 PARAMETERS

The P-55 parameters are organized into three groups: Part Parameters 1, Part Parameters 2, and System. Part Parameters 1 and 2 can be set independently for each of the three Parts, while the System parameters are global. Virtually all the default settings can be altered.

The first set of Part Parameters are used to assign Instruments to each multitimbral Part and set the MIDI channel, level, pan, reverb depth, chorus depth, and Key Shift (transposition). The second group of Part Parameters sets the brightness and Velocity curve for each Part, selects the Sub-Instruments, and sets the Sub-Instruments' Stretch (tuning curve, discussed shortly), detune, level, transposition, and split point. There are nine Velocity curves, which are graphically depicted in the manual.

Most of the System parameters relate to the P-55's extremely flexible global tuning options. You can tune A4 to 415.3, 440, or 466.2 Hz (used in the Renaissance period). With Baroque Pitch on, A4 is tuned to 415 Hz, as used in the Baroque period, instead of the modern 440 Hz. The other global A4 tunings are active with Baroque Pitch on, but they are shifted down by 35 Hz (i.e., A4 = 380.3 or 431.2 Hz), so I don't know why you'd want them.

Besides equal temperament (the default), five alternate temperaments are provided for European historical-music buffs: just, meantone, Werckmeister, Kirnberger, and Pythagorean. You can set the tonic to any major or minor key for use with the alternative temperaments, which is an excellent feature.

The P-55 can operate in any of six MIDI Reception modes. In all modes, the unit receives note and pedal messages, including Damper (64), Sostenuto (66), and Soft (67). In the default mode, it also receives Volume, Expression, Pan, Reverb Depth, Chorus Depth, Bank Select, Program Change, and SysEx (including GS Reset/Exit and GM System On/Off). The other five MIDI Reception modes disable the recognition of various MIDI messages.

CALLING ALL SOUNDS

The Kurzweil and Roland modules each supply 32 presets, called "Programs" on the MicroPiano and "Instruments" on the P-55. MicroPiano Programs include seven acoustic pianos, ten electric pianos, five organs, five string sounds, two piano/string layers, a piano/organ layer, an electric piano/string combo, and a Slow Digital Pad. The balance between sounds in the combo Programs can be controlled with the mod wheel. Every one of these sounds is quite good; in fact, one difference between the MicroPiano and the other two piano modules is that the others have at least a few losers.

Roland gave the P-55 good pianos and plenty of programming features, including alternate tunings, several "stretch" tuning curves, and multitimbral operation. The 28-voice polyphony is a bit misleading in practice, however.

The P-55 offers thirteen acoustic pianos (including two honky-tonks), four Rhodes emulations, half a dozen electric pianos, two harpsichords, three vibraphones, a celesta, and a clavinet. There are also two piano-plus-pad combinations, which seems odd in a multitimbral module with Sub-Instruments. Why not just put two pads in these locations and let the user layer them as desired?

P-55 Instruments can be called up with Program Changes using either of two global Instrument Tables. Table 1 provides all 32 Instruments, in order, using P-55 Instrument numbers. Table 2 is set up for General MIDI, with access to seventeen sounds; ten Instruments follow the GM Program Change map, while the remaining seven are variations of the ten basic sounds. You can select sounds in Table 2 Bank Select (Control Change 0), value, and the appropriate GM Program Change number. (The MicroPiano's Program numbers are not General MIDI-compatible.) The P-55 expects to receive Program Changes numbered 1 to 128; with a Program Change source that uses numbers 0 to 127, sending Program Change 0 calls up Program 1.

I auditioned the three piano modules with an 88-key weighted keyboard and several unweighted controllers. The tunes included Motown-type R&B (bass, pianos, organs), country swing (bass, pianos, strings), bop and post-bop jazz (bass, pianos, vibes, celesta), old-time blues (pianos), and medium country-rock (pianos). All tunes were performed solo and in sequenced ensemble. The P-55, MicroPiano, and an updated Proformance were compared, along with a series of samples on the Kurzweil K2000RS and Ensoniq ASR-10. The P-55 harpsichord and clavinet were tested only briefly.

CATCH THE BEAT

When you boot the MicroPiano, it defaults to Program 1, a "beat-tuned" Classical Piano. Program 2 is a "beat-tuned" Stage Piano, while Programs 3 and 4 are "440-tuned" Classical and Stage Pianos, respectively.

What is a "beat-tuned" piano? In tuning an acoustic piano to equal temperament, you might expect the octaves to be "perfect," i.e., when you play an octave interval, you expect no audible beats. But in fact, all pianos have a certain amount of inherent *inharmonicity*. To greatly oversimplify, this means that the upper harmonics in piano strings are naturally a bit sharp, although the exact amount varies between instruments. The best a piano tuner can do is listen to the loudest coincident harmonic beat and tune it as close to beatless as possible, while other, secondary coincident harmonics continue to beat. This is fine with a single octave, but it gets complicated when tuning the double octave and beyond, as the secondary harmonics start becoming noticeable.

To make the extended octaves sound acceptable, all octaves are "stretched" away from the center of the keyboard (around A4) so they are slightly wider than a perfect ratio of 2:1. The high range is stretched up and the low range is stretched down. The amount of stretching required varies between pianos. This has a cumulative effect, though. Generally, the last few notes in the treble are about 25 to 35 cents sharp with respect to the center octave,

with similar stretching in the bass.

Kurzweil calls this "beat" tuning in the MicroPiano, and Roland calls it "stretch-tuning" in the P-55. Stretch tuning gives a piano more bite and projection, but the extreme highs and lows sound out of tune with other instruments. It's a subtle difference, but you can hear it in orchestral recordings. To check this out, listen to piano and piccolo unison parts, where it's fairly obvious. In an orchestra, the string and wind players, following their trained ears, naturally compensate by altering their pitch. But with layered electronic instruments, you would have to use Pitch Bend to minutely tweak each note by ear, which is nearly impossible.

Kurzweil addressed this by providing two preset, beat-tuned, acoustic pianos for realistic solo work and an A-440 tuning for all other sounds. Kurzweil's A-440 tuning has virtually no stretch in its octaves, so there is a pronounced beating in double octaves. Although the A-440 tuning matches other electronic instruments well, it sounds noticeably out of tune when played solo. Here the P-55's memory is handy: Roland lets you select any of three stretch-tuning curves for each Sub-Instrument, which is a superior solution.

THE MAIN EVENT: PIANOS

All the MicroPiano and P-55 acoustic pianos sound very good and have good Velocity responses. The timbre changes significantly with Velocity, not just the volume. The Classical piano is my favorite on the MicroPiano. It's moderately dark, but not dull. The Stage piano is somewhat brighter and equally usable for solo work. The Bright piano is indeed brighter and more percussive, but not dramatically so. It worked well in ensembles. The Sustain piano has a slightly longer decay.

I'm not convinced the Tack Piano sounds like a real tack piano, but it is the only MicroPiano acoustic that sounds dramatically different from the others, adding a strong percussive attack and very bright sound. Unlike the E-mu Proformance, the MicroPiano has neither a moody, dark acoustic piano, nor a painfully bright one with a normal attack.

The P-55 has a greater variety of pianos, which you can EQ with the Brilliance control. Except for an unsatisfactory Honky Tonk piano, the pianos' basic quality is quite good. However,

they sound as if they were sampled with reverb, even when the effects are off. Some of the P-55 grands sound like ancient uprights, which isn't necessarily a bad thing. Still, I give a slight edge to Kurzweil and E-mu for piano sound quality, as I prefer their drier samples. You can always add reverb.

ELECTRIC AND ELECTRONIC PIANOS

The MicroPiano's ten electric pianos offer more variety than its acoustics, though not as much as the number of programs indicates. The Bright and Tight Electric Grands are almost identical. They are tight, punchy, and reasonably electric grand-like. The appropriately named Warm Electric Grand has a lot more harmonics for a darker, denser sound. The Digital Electric Grand vaguely reminds me of the Yamaha CP35. The Classic Electric Piano emulates a Rhodes, though you'll never mistake it for the real thing. The remaining Electric Pianos give you a decent variety of digital and Rhodes-like timbres.

Some P-55 electrics sound like EQ'd versions of the acoustics, with a few leaning toward the Yamaha CP70 sound. The Rhodes variations emulate the characteristic attack of the real thing, but mate it with a cold, clear FM-like sustain section. These are good sounds, and you can tweak their Brilliance and effects. I like the MicroPiano preset electrics a bit better. Still, I consider them mostly a bonus, as good electric piano sounds are commonplace.

OTHER VOICES

The MicroPiano offers five good organ Programs. One of the two Rock Organs is warmer, while the other has more clarity. The Percussion Organ lives up to its name, with lots of attack and brilliance. There are two Ballad Organs; one is cold, clear, and digital-sounding, and the other has more harmonics for a warmer, denser sound. The rotary-speaker effect (or the tone-wheel vibrato on the Percussive Organ), triggered with Modulation, is surprisingly good. There's one Organ and Piano combination, which was less than thrilling.

The five MicroPiano String programs provide a bit more variety than the other sounds. You get two Fast Strings Program, plus Stereo Slow Strings and Stereo Slow String Pad. These sounds are clean enough, and as a throw-in, they're nice to have.

The P-55's nonpiano Instruments are mostly ho-hum, but they help differentiate the Roland and Kurzweil units. There are no strings or organs in the Roland module, and none of the supplemental Roland sounds appear in the MicroPiano.

The P-55's two harpsichords are lame; enough said. The clavinet ranks slightly above the harpsichords. There are three vibraphones: a good synth vibes with a hard mallet, a usable one with a softer mallet, and one I'd just as soon skip. The celesta sounds like a variation on the vibes. It seems this unit has relatively few samples in it; many sounds appear to be synthesized with EQ and envelopes.

Overall, you get decent, usable supplemental sounds in both boxes, but the MicroPiano definitely gets my vote. I would have liked a few bass sounds, but with no memory, you wouldn't be able to set the range or split point. (The Proformance's best "extra" sound is the acoustic bass.)

EFFECTS

Both the MicroPiano and P-55 have simple effects processors that produce reverb and chorus. Kurzweil's effects processor offers sixteen effects settings, including eight reverbs (Room, Stage, and Hall variations), a straight chorus, and assorted combinations of reverb with chorus. Finally, there is a symphonic reverb-plus-echo combination called Deep Space. (No, it's not algorithm 9).

Product Summary

PRODUCT:
P-55 Sound Canvas piano module
PRICE:
$695
MANUFACTURER:
Roland Corporation US
7200 Dominion Circle
Los Angeles, CA 90040-3647
tel. (213) 685-5141
fax (213) 722-0911

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ● ● ●
EASE OF USE	● ● ● ◖
QUALITY OF PRESETS	● ● ● ◖
VALUE	● ● ● ◖

The MicroPiano's reverb is not the greatest; I preferred to turn it off for the acoustic pianos and use outboard processing. Copious chorusing and light touches of reverb were more useful on organs, electric pianos, and strings.

After some initial experiments, I controlled the effects from a sequencer, working around the unit's lack of memory. The MicroPiano lets you select the effects type with MIDI Control Change 83 messages, edit the reverb wet/dry mix with Control Change 91, and adjust Chorus wet/dry mix with Control Change 93.

As with the MicroPiano, the P-55's reverb and chorus parameters are global, not selectable per Instrument. Several effects parameters are available through MIDI System Exclusive. For reverb, you can set level, time, delay feedback, and send level to the chorus via SysEx. For the chorus, you can edit level, feedback, delay, rate, depth, and send level to the reverb.

There are also a few poorly documented effects parameters. Reverb Pre LPF and Chorus Pre LPF appear to control the levels going into a fixed lowpass filter. Reverb Character is more mysterious, as it does not relate to reverb type (e.g., hall, room, etc.). Presumably, it is some sort of macro that controls diffusion and other unnamed parameters.

In general, the P-55's chorus sounds thin and watery, but it still helps the digital-sounding electric pianos, vibes, and so on. The reverbs benefit from a little SysEx tweaking, but I was not thrilled with them. For sound quality, I prefer the MicroPiano effects, espe-

Product Summary

PRODUCT:
MicroPiano piano module

PRICE:
$499

MANUFACTURER:
Kurzweil/Young Chang
13336 Alondra Blvd.
Cerritos, CA 90701-2205
tel. (310) 926-3200
fax (310) 404-0748

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ●
EASE OF USE	● ● ● ● ◖
QUALITY OF PRESETS	● ● ● ●
VALUE	● ● ● ●

cially the chorus, but I wish Kurzweil offered a SysEx implementation like that of the P-55. In the end, neither is killer stuff.

GREAT EXPECTATIONS

I began this review expecting the acoustic-piano sound quality to be the determining factor. Indeed, there are noticeable timbral differences, just as there are between different acoustic pianos. But the MicroPiano and Proformance are a close match for quality, and the P-55 is not far behind. When compared with assorted 3 MB third-party samples for the Kurzweil K2000RS, all three piano modules held up quite well, though a few very large samples offered superior detail and responsiveness.

The MicroPiano and P-55 offer radically different feature sets. (The Proformance is closer to the MicroPiano in this regard.) Each module offers distinctive features, including a differing set of supplemental sounds, such as electric pianos, vibes, and organs.

The MicroPiano has two feature advantages, the most important of which is true 32-voice polyphony. Not sixteen voices like the Proformance and not the P-55's more-or-less 28-voice polyphony, with ifs and buts. For a pianist, that's terrific. Its other advantage is its better secondary sounds, such as organs.

On the other hand, the P-55 has more of just about everything else. If you want to do layering, custom splits, or multitimbral sequencing, and you favor a reverberant piano sound, spend the extra money to get the P-55. (The Proformance gives you a few Preset splits, but the only user variable is the split point.)

If all you need are a few superior pianos and perhaps a bass, without onboard processing, and you don't like the MicroPiano's refusal to remember your settings, get the Proformance/1+ (reviewed in the November 1990 **EM** and since renamed Proformance Plus). If you want your module to come with a few solid electric pianos and organs, and you don't need to program, get the MicroPiano.

Every gear magazine needs a professionally picky products person. **Steve O.** *has grown into that role for* **EM**.

For Reader Service information:
Circle #439 for the P-55;
Circle #440 for the MicroPiano

E-MU'S PROFORMANCE REVISITED

In 1990, E-mu brought out the Proformance, a half-rackspace, 16-note polyphonic, sampled piano module. The Proformance/1+ (reviewed in the November 1990 **EM**), a version with supplemental sounds, was also released.

While it sounded quite good at the time, the Proformance had its limitations in retrospect. Many users complained about its short envelopes and inadequate timbral changes in response to Velocity. Most of the supplemental sounds in the Plus were thin-sounding, though useful for layering. There is no power switch, no headphone jack, and no effects.

In late 1993, E-mu brought out a slightly tweaked version of the Proformance/1+ and renamed it the Proformance Plus. The supplemental sounds are the same. But the acoustic pianos, which are the unit's reason for existence, have longer envelopes and better timbral response. The changes are subtle, but they help keep the unit competitive.

The Proformance is as simple a sound module as you can find. Rotary knobs handle master volume and fine tuning. Multiposition knobs select the MIDI channel, transposition, and preset, with detents at each position. The unit only operates on MIDI channels 1 to 13, as the MIDI Channel knob also accesses the keyboard split feature, enables Omni mode, and triggers the demo sequence. E-mu ran out of knob space before running out of MIDI channels.

Fifteen Presets can be selected from the front panel, including four acoustic pianos, two electric pianos, two organs, straight and bright vibes, a digital piano, and a bell-like synth piano. Three splits match acoustic or electric basses with piano, organ, and electric piano. The split point can be set via MIDI.

One position on the Preset knob allows MIDI Program Changes, which not only let you call up the same fifteen Presets as the front panel, but access seventeen additional Presets. Eight of these are the acoustic pianos with different Velocity curves. There's also a honky-tonk piano, an FM-like digital keyboard, a few detuned acoustic pianos, and more splits.

Two things set the Proformance apart from the MicroPiano and P-55. First, the piano is sampled in true stereo, although it sounds fine in mono. True stereo is a nice touch, but you must be careful about phase relationships at mixdown. Second, it has bass sounds. In fact, the basses, especially the Acoustic Bass, are the best sounds on the instrument other than the acoustic pianos.

The four acoustic pianos in the revised E-mu unit are every bit as good as the MicroPiano or P-55. The Dark Grand, Classic Grand, Mellow Ivory, and Rock Piano are each distinctive; the Dark Grand is my favorite for quiet solo pieces, while the Rock Piano is unbearably bright alone but shines in a full ensemble. They offer a lot more variety than the MicroPiano acoustics and less variety than the piano-heavy P-55. Other sounds include several nondescript digital pianos and organs. E-mu Systems; tel. (408) 438-1921; fax (408) 438-8612.

E-mu's recently updated Proformance Plus is easy to use and has excellent piano sounds. Unlike the other piano modules, it also has good bass sounds. The downside: The other supplemental sounds aren't the greatest, and it is limited to 16-note polyphony.

usWaves Q10 1.1 (Mac)

By David (Rudy) Trubitt

From the Middle East comes parametric EQ software for Digidesign systems.

Don't touch that dial! Conventional wisdom says you should fix a sound at its source before reaching for EQ. No knob can tune a bad-sounding drum or make an old set of strings sound new. Still, it's an imperfect world. You moved the mic, tuned the drum, or changed the strings, and you're still not satisfied. It's time to reach into your bag of tricks.

Q10, from Israeli software developer usWaves, provides users of Digidesign Pro Tools, Sound Tools, Sound Tools II, ProMaster 20, or Audiomedia II hard-disk recording cards with a 10-band, fully parametric stereo equalizer. For those who are happy just to have swept mids on their mixers, a 10-band parametric might seem like overkill. But once you've experienced a truly flexible equalizer, you won't think so. (To brush up on equalization techniques, check out the October 1993 "Recording Musician.")

Before we get into details, it's important to understand that *Q10* is not a self-contained solution. You're buying software on a floppy disk, not a knob-encrusted black box. The program requires a Digidesign NuBus sound card installed in a Macintosh. (I used a Mac IIcx with 8 MB of RAM and Sound Tools II.)

PLUGGING IN

Q10 is the first third-party software "plug-in" created to add new functions to Digidesign's *Sound Designer II* audio-editing software. A plug-in can't be launched from the desktop. Instead, it goes into a special "Plug-ins" folder in your *Sound Designer II* application folder. When you run *Sound Designer II*, *Q10* appears as an option in *Sound Designer*'s DSP menu. (For more about plug-ins and Mac-based signal-processing, see "Virtual Effects" in the March 1994 issue.)

If you're familiar with *Sound Designer II*'s built-in DSP functions, you already know how to use *Q10*. When you select a piece of audio and open *Q10*, you can preview that segment while adjusting the controls. If nothing is selected, *Q10* plays the section of audio currently in RAM.

After you have made your adjustments, you have three choices: permanently (destructively) process the selected audio with the new EQ curve, process the entire file, or apply the EQ settings on playback without changing the disk file. Although usWaves is considering software that would allow *Q10* to process audio in real time, there is currently no way to "insert" *Q10* in an audio chain outside of the Mac.

THE FILTERS

The heart of an equalizer is its individual filters, and *Q10*'s are extremely flexible. Each can be set to any of five filter types: parametric/peaking, high shelving, low shelving, highpass, or lowpass.

Every band has its own center-frequency setting (16 Hz to 21 kHz), cut/boost level (±18 dB), and continuously variable "Q," or bandwidth control. (Q is only active when the parametric filter is chosen.) Multiple filters can be overlaid to create extremely steep EQ slopes.

Each filter has its own in/out button, and there is a global Bypass button for comparing an equalized signal with the flat response. In addition, you can store a "B" EQ curve, which lets you compare two different EQ settings.

USER INTERFACE

Of course, this tone-tweaking power would be worthless without an easy way to use it. *Q10* provides a much richer user interface than the equalizers in *Sound Designer II*. The current settings of all ten bands are displayed in two ways: graphically and numerically. You can edit either representation and see the changes reflected in both.

Q10's centerpiece is a graph that shows the combined frequency-response curve of all active filters. By default, the left and right channels share the same EQ curve, but you can set up completely different curves for each. When the left and right responses are different, their curves are shown separately on the same graph.

The ten bands are displayed as little rings located above, below, or along the EQ curve (see **Fig. 1**). Their vertical (Y axis) locations on the graph indicate amplitude, and their horizontal (X axis) locations indicate center frequency. You can select them with the mouse to adjust them graphically. Vertical "mousing" adjusts a filter's boost and cut settings, while a horizontal motion sweeps the center frequency up and down. Holding the Option key causes horizontal mouse motion to modify the Q setting. The Control key momentarily "locks" the mouse to *only* horizontal or vertical movements. Finally, multiple filters can be selected by Shift-clicking and controlled simultaneously as a group.

The graphic window is calibrated with frequency and amplitude markings, but numeric display of filter settings is also provided. Clicking on a number lets you scroll its value with the mouse or type in a value from the keyboard. Text values can also be selected individually or *en masse* and copied and pasted between filters.

Boosting any EQ—analog or digital—can cause overload and distortion. If this happens, the number of samples clipped for each channel is displayed above a pair of input-attenuation faders. (Make sure you preview the loudest section of the piece to avoid any surprises.) Similarly, cutting a lot of frequencies can drop the average levels, so a pair of output faders with up to 10 dB boost is also available.

In every case, *Q10*'s text and graphic displays give you quick, precise control over all filter settings. It's an extremely well-conceived interface, and one of the program's greatest strengths.

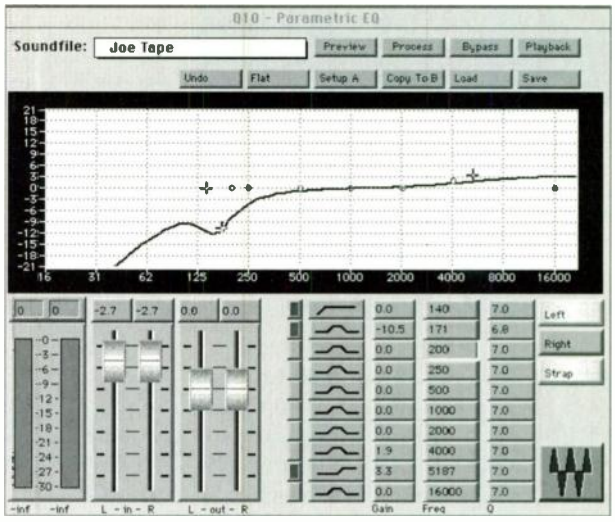

FIG. 1: *Q10*'s main display shows the combined frequency response of all active filters. Note that overlapping bands can keep the curve from passing directly through each filter marker.

The program's appearance is pretty spiffy. However, it gets a little coarse-looking in black and white or 4-bit grayscale. For instance, distinguishing the left and right channel curves, or the on/off status of various buttons, is less clear on basic displays.

In addition, recalculating the frequency-response curve causes a brief, but noticeable, pause on my somewhat poky IIcx. This isn't a big problem, but in at least one case, it could be avoided within the program. Changing filter types requires repeated clicking to cycle through all five options, and each time a new filter type is selected, its contribution to the curve is recalculated. After two or three clicks in a row, the delay becomes annoying. Waves' representative says this is likely to be addressed in an upcoming version.

LIMITATIONS

The availability of third-party plug-ins is a boon for Digidesign users. However, there are a couple of limitations in the plug-in architecture. Although these aren't *Q10*'s fault—Digidesign's *DINR* plug-in is in the same boat—they do impact its utility.

First, if you're working at sample rates other than 44.1 or 48 kHz, you can't preview sounds at their original pitch. *Sound Designer II* does real-time sample-rate conversion for its own needs; that's how it plays a 22 kHz sound. Unfortunately, digital audio is supplied to plug-ins at the card's current clock rate, which is only 44.1 or 48 kHz. *Q10* correctly processes files recorded at lower sample rates, but it sounds funny.

Two *Sound Designer II* Playlist features are also unsupported: attenuation settings for individual regions and the optional fade-in and fade-out curves that

Product Summary

PRODUCT:
Q10 1.1 Parametric EQ
PRICE:
$399
SYSTEM REQUIREMENTS:
Any Macintosh with a full-size NuBus slot; 8 MB of RAM; System 7.0 or later; *QuickTime* 1.5 or later; Digidesign *Sound Designer II* 2.5 or later; Digidesign Pro Tools, Sound Tools, Sound Tools II, ProMaster 20, or Audiomedia II
MANUFACTURER:
usWaves
4028 Papermill Rd. #14
Knoxville, TN 37909
tel. (615) 588-9307
fax (615) 588-9472
Compuserve: 70303.1036

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ● ● ● ◖
EASE OF USE	● ● ● ●
AUDIO QUALITY	● ● ● ●
VALUE	● ● ● ●

can be applied to a complete Playlist. (Crossfades *do* work.) These shortcomings will be corrected by Digidesign's upcoming Time Domain Multiplexing (TDM) architecture for Pro Tools systems. However, it appears that Sound Tools and Audiomedia users will have to live with these limitations indefinitely.

Because you can't use Playlist fades with plug-ins, if you want to use fades in a *Sound Designer II* Playlist and apply EQ, you must destructively process the sound files. This can work two ways: You can destructively record the fades and nondestructively EQ the resulting file during playback, or destructively EQ the original file, then use the Playlist to implement fades.

Destructive equalization can take awhile, though: On my IIcx with a fast 1 GB drive, it takes about 125% of the real-time length of the file, assuming 16-bit stereo, recorded at 48 kHz. In other words, processing a 4-minute song takes about five minutes. Fortunately, *Q10*'s processing is about 10% faster than *Sound Designer II*'s parametric EQ. The Waves program can process at least five bands per channel in the time it takes Digidesign's software to apply only one band.

THE SOUND

I definitely got better results using *Q10* instead of *Sound Designer II*'s single-band parametric or graphic EQ. But a big part of that was the vastly improved user interface and the number of simultaneously available filters and filter types. *Q10*'s flexibility made it possible to quickly experiment with a few ideas and choose the best course.

Then I tried to compare apples and apples. I applied the same settings (boost/cut, center frequency, and Q) to a single *Q10* band and *Sound Designer II*'s parametric. The difference was distinct, although somewhat subtle.

Using a dry kick-drum sound, I applied a very narrow peak (Q=100, a bandwidth of 20 Hz) at 2 kHz, boosted by 8 dB. The *Sound Designer* parametric had a brief, but clear ring or "chirp" at 2 kHz. *Q10* did not. At very high gain settings, there was a minor digital artifact in the *Q10* kick's decay, but that was without using any of the program's three Increased Digital Resolution (IDR) dithering options. With IDR (discussed shortly), the tail had slightly elevated hiss, but no other artifacts.

• Q10 1.1

In another listening test, I took a strummed acoustic guitar chord and applied an arbitrary 9 dB boost at 2.5 kHz, with a broader Q of 7. I applied both *Q10* and *Sound Designer II* EQs. *Q10*'s transient response sounded clearer, more "open," and perhaps a touch harder, while *Sound Designer II* seemed softer, warmer, and cloudier. (Pick the adjective of your choice.) With practice, I could readily distinguish the two, and I preferred *Q10*.

IDR DITHERING

Audio dithering is a process designed to improve the perceived quality of digital sound. When a digital signal is processed (for instance, with EQ, dynamics processing, or gain changes), the number of bits required to represent the signal increases. Many digital signal processors that have 16-bit or better A-to-D converters use 24-bit internal processing to allow for this increase.

However, when the sound is saved to disk in 16-bit format, or reconverted to analog with a 16- or 18-bit, D-to-A converter, the extra bits must be rounded off. For example, with 16-bit files, eight bits must be trimmed off. This results in audible, low-level, nonlinear distortion, which is heard as the "splattery" sound of digital audio fading to silence. (This kind of noise is much easier to hear with 8-bit sound files, but it is present in 16-bit audio, too.)

This problem can be reduced by the use of *dithering*, in which a small, controlled amount of noise (*dither*) is added to the signal. This creates a steady hiss that masks the low-level distortion. To minimize the perceived hiss, Waves' IDR adds dither in frequency regions to which the ear is less sensitive. *Q10* offers three levels of IDR for processing 8-, 16-, and 20-bit digital audio. (Waves' upcoming *L1* limiter plug-in will have a more extensive IDR implementation.)

THE ENVELOPE PLEASE...

At $399, *Q10* costs a fraction of what you'd pay for a comparable hardware equalizer. Still, I have a few concerns and wishes. To begin with, it would be nice to have some sort of automation. Even responding to MIDI controllers would be enough to cobble up a solution through a sequencer or MIDI fader box.

Also, the disk-based copy protection can be a nuisance. I run *Sound Designer II* from more than one drive because its temporary files are stored on the drive where the application resides. This requires using both installs.

Finally, the long-term outlook for plug-ins is complicated. Digidesign's focus is clearly on TDM, and TDM plug-ins won't be compatible with today's *Sound Designer II* plug-ins. (Waves and other plug-in developers are planning or have announced TDM versions of their products).

Compounding the problem, Digidesign won't provide their *Sound Designer II* plug-in format to developers of stand-alone programs such as *Studio Vision*, *Logic Audio*, or *Deck II*. This means plug-in developers will have to write a new TDM version and yet another version to support non-Digidesign applications, which is unfortunate news for developers and end-users alike. As a result, I recommend you make your plug-in purchases based on what they can do for you *today*, not what might be possible in the future.

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Q10 provides a much richer user interface than the equalizers in *Sound Designer II*.

That said, I'm still sold on *Q10*. The benefits of a sophisticated equalizer are clear enough, and the power and flexibility of this EQ is a big addition to *Sound Designer II*'s bag of tricks. But there's more. Without an EQ capable of such critical adjustments, it's difficult to sharpen one's skills. Not only did *Q10* help the projects on which I used it, my ears learned a thing or two, as well. I think that's the best contribution any tool can make.

David (Rudy) Trubitt *is a freelance audio guy living in the San Francisco Bay Area.*

Circle #441 on Reader Service Card.

MESA/Boogie TriAxis Guitar Preamplifier

By Richard Chycki

Boogie racks up its best guitar-amp sounds.

The guitarist's never-ending quest for the ultimate tone usually consists of barbarically plugging a favorite guitar directly into the front of a Neanderthal amp and cranking it up. Until the last few years, if you wanted a variety of vintage and hot-rodded tones for contemporary guitar playing, you usually needed several amps, effects processors, and preamps. As a result, there is a thriving market in amp emulators (e.g., the Tech 21 Sans Amp) and MIDI-controlled tube preamps.

It was only a matter of time before MESA/Boogie jumped into this hot market. Long known for their hard-rocking guitar amps, Boogie has consolidated their best amplifier designs into the TriAxis MIDI-controlled tube preamplifier.

CONSTRUCTION

The TriAxis' all-steel chassis feels substantial. It extends almost fifteen inches into the rack, so rear support is advised for road transport. A peek inside reveals a clean layout that uses a toroidal transformer and liberal wire/case shielding for minimum noise. The digital control circuitry and analog preamp boards are physically isolated from one another.

The five 12AX7 tubes are mounted laterally in a recessed cavity on the rear panel, which provides quick tube access without removing the TriAxis from its rack. The tubes have proper ventilation and are well protected by the surrounding steel panels.

AUDIO CONNECTIONS

Boogie has maximized its use of the single-rackspace device's panel space. All inputs and outputs use rear-panel, ¼-inch, unbalanced phone jacks. Although the front panel is packed already, an additional input jack in front would have been appreciated.

One pair of line-level stereo Record

outputs have an unconvincing speaker-simulator circuit for direct connection to a recording console, and a second pair feed the dry signal to a stereo power amplifier and speakers. Sadly, no headphone jack is in sight.

The mono send/stereo return effects loop is programmable from the front panel. Most so-called "stereo" guitar-effects processors sum the inputs to mono and output a pseudo-stereo signal, so this arrangement is acceptable. Four ¼-inch footswitch jacks can automate effects switches or the power-amplifier modes available in some Boogie power amps.

CONTROLS

The front panel has an impressive lights-per-dollar ratio. Many of the controls found on Boogie amplifiers are here, albeit in button/red LED form. These controls are light-controlled variable resistors (standard control pots are variable resistors) that are under digital control, so the audio path's integrity is not compromised by solid state or digital circuitry.

Like the other settings, the presets are accessed with buttons below LED indicators. A green LED panel displays MIDI Program, channel, and Continuous Controller information. The eight preamp modes (discussed shortly) scroll via the Mode switch. The parameters remain at their settings when you change modes, so changing while programming can result in a hefty volume blast if you're not careful. The Loop Switch button offers a similar scrolling feature for the programmable switches and effects loop. Pushing and holding any control on the front panel provides accelerated value changes.

Hitting the Shift button three times

ADA MICROCAB GUITAR CABINET EMULATOR

Occasionally, recording guitar direct offers benefits that speakers simply cannot deliver. Low-level home recording comes to mind, but recallable consistency is a clear benefit to recording guitar direct, especially when coupled to a programmable unit like the TriAxis. The ADA MicroCab ($249.95) is designed to replace amp-miking live or in the studio, emulating the characteristics of a Shure SM57 close-miking a variety of Celestion-loaded boxes and providing a P.A. feed from its preamp output.

The unit emulates open-backed 1 x 12, 2 x 12, and Vintage 2 x 12 speaker configurations and sealed-back 1 x 12, 2 x 12, Vintage 2 x 12 , 4 x 12, and Vintage 4 x 12 cabinets. Eight front-panel switches make the cabinet emulations a touch away. A drive-level control and associated clip LED optimize circuit headroom. For fine-tuning the simulations, Thump and Hi Balance controls adjust the low-end and high-end responses, respectively.

I tested the MicroCab with Marshall amps, Fender amps, the MESA/Boogie Dual Rectifier Solo Head, and the TriAxis. Amplifiers with effects sends or preamp outs easily interfaced with it. I was able to duplicate the test reference (a Celestion-loaded, 4 x 12, closed cabinet, miked with an SM57) by applying a slight midrange bump and slight low cut. Not a trace of DI artificial amp sound was apparent; the signal was speaker-like, even in the critical high-end spectrum where that telltale 12 kHz "rizz" is the usual giveaway.

One important aspect of cabinet miking is the comb-filter effect generated by the audio signal reaching the microphone from more than one source at slightly different times. For example, in a 4 x 12 box where one speaker is miked, three other speakers also blast audio into the microphone, the audio from the unmiked speakers arriving at the microphone approximately 2 ms later. ADA used a complex set of active filters and delay lines to accurately reproduce these other audio paths for added realism.

Each MicroCab channel has a pair of parallel, ¼-inch jacks capable of accepting a +20 dBV level. The unit has unbalanced, ¼-inch and balanced, XLR outputs. A wall-wart AC adapter supplies power.

Tube-amp power-output sections become upset when run without a load attached, and the MicroCab does not contain a speaker load. Connecting the MicroCab directly to the speaker outputs will blow up the MicroCab, as it's not designed to handle speaker-level signals.

The bottom line is the MicroCab sounds great, is cost-effective, and provides a convenient way to get guitar tones to tape. ADA Signal Processors, Inc.; tel. (510) 532-1152; fax (510) 532-1641.

ADA's MicroCab emulates the characteristics of a Shure SM57 close-miking a variety of open- and closed-back, Celestion-loaded speaker cabinets.

places the TriAxis in Continuous Controller programming mode. A handy, dual-concentric Output control can tweak the output level without affecting the master volume settings in the programmable section.

A LA MODES

Each of the TriAxis' eight preamp modes is based on one of the company's proven designs. Each of the eight modes offers a complete preamplifier, categorized into three groups: Rhythm, Lead 1, and Lead 2.

There are two Rhythm modes, designated Green and Yellow. Rhythm Green is Boogie's classic preamp and sounds much like their first amplifier incarnations. Its response is slightly darker than the Rhythm Yellow mode, with extra bass response in the sub-bass

▼

Switching presets is almost glitch-free.

regions. (Are you bass players getting ideas?) Lower gain settings are reminiscent of the early Fender days, while higher gain settings produce a touch-sensitive overdrive that doesn't squelch the guitar's inherent overtones.

Rhythm Yellow sounds identical to Channel 1 of a Mark IV combo. Both the bass and treble center frequencies seem to shift upward, compared to the Rhythm Green mode, with more attack and articulation. The sound is open and clean.

The three Lead 1 modes have one thing in common: post-gain tone controls. Boogie's first Mark I series of amplifiers ushered in the concept of high-gain amplification for guitarists, which is great for getting extreme crunch.

Lead 1 Green mode is the high-gain channel of a Mark I amplifier. It provides the fat, warm sound that was featured on Santana's *Abraxas* album. Lead 1 Yellow is similar to the Green mode, but with more gain in an early tube stage for a more saturated sound and more sustain. There also is a boost in the medium midrange. It's darker and smoother than Lead 1 Green.

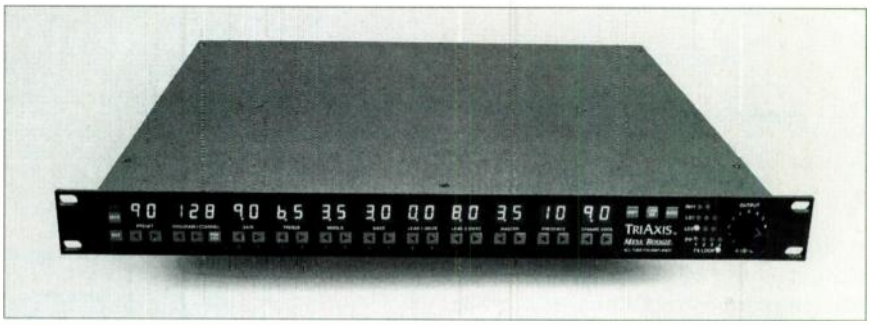
Lead 1 Red, Boogie's latest in high-gain amp design, sounds much like the

Vintage Orange channel of the Dual Rectifier Solo amplifier. Boogie has dedicated an entire internal PC board for this ultra-crunchy sound. The bass control is notably affected, as the bass can easily be cranked up. Indeed, coupling these tone controls with the Dynamic Voice function could easily result in EQ overkill if care is not exercised.

Boogie also perfected a system, implemented in the Mark II, III, and IV amps, where additional gain stages were switched into a preamp circuit after the tone control. The 5-band graphic EQ offered users the option of post-distortion tone shaping in those amps. The Lead 2 modes provides this modern, tight Boogie sound.

All three Lead 2 modes are similar in gain; EQ frequencies are the predominant difference between them. Lead 2 Green mode is from the Mark IV amplifier's Lead mode, with boost engaged. It is intended to deliver midrange punch, useful for single-note melody lines. Lead 2 Yellow takes a step back into the past to reincarnate the Mark IIC lead sections, without the channel interaction that was a hassle back then. Lead 2 Red is a souped-up, extremely cutting version of the Mark III head's Lead mode.

Because of their inherent post tone-stage gain design, all three Lead 2 modes are restricted in the amount of low end that can be added via the pre-gain bass control. The Dynamic Voice function seems to really shine when used with any of the Lead 2 modes.



MESA/Boogie's TriAxis guitar preamp provides the killer sounds of the manufacturer's finest vintage and modern guitar amps. It offers MIDI continuous control of almost all parameters.

EQUALIZATION

The TriAxis contains two simple EQ sections and a Presence control. The conventional treble, middle, and bass controls are similar to those in the front end of earlier Boogies and Fenders. The EQ changes signal-chain positions from mode to mode, sitting early in the amp circuitry for most modes and ending up at the end of the gain stages (preeffects loop) for the Dual Rectifier-esque Lead 1 setting.

The Dynamic Voice control is the only user-programmable parameter on the second EQ section, and is based on Boogie's popular, 5-band graphic EQ. (The bands are centered at 80 Hz, 240 Hz, 750 Hz, 2.2 kHz, and 6.6 kHz.) Increasing this parameter's value is analogous to deepening a "V" curve on the graphic, boosting the lows and highs and cutting the mids. Increasing Dynamic Voice also increases the wet/dry mix, so that at 10, the mix is 100 percent wet. The Dynamic Voice section occurs late in the circuit and is especially intended to enhance the post tone-control Lead 2 circuits.

The Presence control regulates the TriAxis' high-end response. Like a standard guitar-amp Presence control, it uses a negative feedback circuit to control the high-end. However, unlike a power-section Presence control, the TriAxis uses a proprietary compression circuit coupled with a feedback loop to further enhance the control's effectiveness. For example, the Presence circuit tracks the entire spectrum of the neck, adding more high-end harmonics to low notes and less to higher notes that are already cutting.

MIND IF I SMOKE?

The TriAxis includes 90 presets; the first twenty are in ROM, and the remainder are user-programmable. Presets 1 to 10 are emulations of Boogie's more popular sounds from all eras, Mark I through to Mark IV, and the Dual Rectifier. Presets 11 to 20 are identical to the first ten, but with vari-

ous power-amp switch modes for use with MESA/Boogie Switch Track power amps.

I found all the presets palatable and usable right out of the box, with little or no tweaking. Overdrive was exceptionally smooth, without a hint of the annoying buzz that typifies amps with solid-state clipper diodes. I was able to get a great high-gain, Marshall-type tone, as well as any vintage Fender sound imaginable.

The Dynamic Voice control seemed particularly crucial for that British sound. Combining the Dual Rectifier setting (Lead 1) with the modern setting on the Stereo Simul-Class 2: Ninety power amp is a great replication of the actual Dual Rectifier head (using the solid-state power setting on the head).

In Lead 1 mode, the gain was so intense that gain and drive settings of greater than 7.0 produced no further overdrive. In fact, when maxed out (read: abused), the tubes were driven into cutoff. Considering the amount of screaming gain available, the TriAxis is surprisingly quiet.

Preset switching is often an issue with players. After all, who wants a moment of silence or a big bang in the middle of a performance or recording? The TriAxis does not disappoint in this area: Switching presets is almost glitch-free, with an ultraquick, fade-like transition between presets. There are no clicks or pops.

For my listening tests, I used several standard reference guitars: a Strat, a Telecaster, a Les Paul, and a Gibson ES 175. Speakers were a MESA/Boogie 4 × 12 with Celestion Vintage 30s and a Marshall 4 × 12 with E-V 12LSIIs. The system remained true to the guitar at any setting.

MIDI FEATURES

The TriAxis also offers the obligatory triad of MIDI In, Out, and Thru jacks. The MIDI Out sends SysEx Bulk Dump and Program Change information. The MIDI In is a nonstandard, 7-pin jack that uses the extra two pins to "phantom power" any MIDI controller that can accommodate this feature, such as Boogie's Abacus or the ADA MC-1 foot controller. A coaxial jack located above the main AC line cord accepts an optional, external AC adapter that supplies power to the MIDI In jack. Fortunately, a standard MIDI 5-pin DIN plug can mate with the 7-pin jack, so you can use the TriAxis with regular MIDI devices such as a sequencer.

Version 2.0 of the TriAxis operating system supports MIDI controllers that alter the front-panel settings in real time. Any or all of the nine variable parameters can be assigned to one of 120 MIDI controller. More complex set-ups would benefit from multiple MIDI controllers modifying a single parameter. Unfortunately, the mode, switch status, and effects loops cannot be assigned to MIDI controllers.

The scaling factor, which determines the controller's value and polarity, can be stored for each parameter and saved for each preset. Each parameter has sixteen increments, and some audible stepping is slightly evident when gain stages are adjusted under certain conditions. In most situations, this stepping would not be a problem.

Programming the TriAxis to process MIDI controller information was confusing the first time, as the only feedback from the unit is a sequence of flashing displays. Even some broken text in the LED displays, as on some A.R.T. processors, would have helped. The front-panel value indicators change in real time to reflect parameter changes via MIDI. Way cool.

Imagine this: You can have a single MIDI pedal that, when pulled back, sets the controls on the TriAxis for a clean Fenderish tone. Leaning on the pedal increases the gain and lead drive, lowers the master volume, and equalizes the signal for a chunky lead tone. The first time I tried this, the sensation was like having four people behind me adjusting all the controls on my amp with synchronous precision.

Product Summary

PRODUCT:
TriAxis tube preamp

PRICE:
$1,395

MANUFACTURER:
MESA/Boogie Ltd.
1317 Ross St.
Petaluma CA 94954
tel. (707) 778-6565
fax (707) 765-1503

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ● ● ●
EASE OF USE	● ● ● ●
AUDIO QUALITY	● ● ● ● ●
VALUE	● ● ● ● ●

THE PERFECT COMPANION

Although any power amp could bring life to your speakers, Boogie strongly recommends using their all-tube Stereo Simul-Class 2: Ninety ($995). This 38-pound, 2-rackspace behemoth takes advantage of the TriAxis' switching capabilities, altering the negative feedback path (for a more aggressive tone), modifying the low-end response, and reducing the output power as desired.

Each channel uses a quartet of 6L6 power tubes, laterally mounted as in the TriAxis, with an added fan for ventilation. Output power is conservatively rated at 90-watts per channel. The 2: Ninety also uses Boogie's proprietary Simul-Class technology, which combines the efficiency of a Class B amp with the sweetness of a Class A output section.

Users of other tube power amps, or those wishing to use their guitar-amp head as a power amp via the effects return jack, will also find the TriAxis an amiable partner. It still offers all the tone response expected from a Boogie tube preamp, with the additional benefits of programmability. Solid-state power-amp users who like the solid-state's superhigh dampening factor will enjoy the ultratight low end of the TriAxis, especially in the Lead 2 and Lead 1 Yellow modes. I also had tremendous results using this preamp direct to the console.

IN THE END

It's plain and simple really: The TriAxis sounds like a bunch of different killer amplifiers because it *is* a bunch of killer amplifiers, albeit under one digitally controlled roof. That control allows for sophisticated manipulation of the guitar signal centered on what most guitarists hold true to their hearts: tubes.

The TriAxis delivers consistent, full tone. It is expensive, but it's a no-compromise tool catering to plug-and-play axemen and ultra-tech-head, sophisticated gear-mongers alike. I highly recommend it.

Richard Chycki *is a producer/engineer/guitarist in Toronto, Canada, who has worked with Skid Row's Sebastian Bach, James LaBrie of Dream Theater, and Jeff Healey.*

Circle #442 on Reader Service Card

Sampleheads Will Lee Bass Library, Vol. 1

By Al Eaton

Getting to the bottom of a great sound.

What do Donald Fagen, Barbra Streisand, George Harrison, Frank Sinatra, Mariah Carey, Ray Charles, and Vanessa Williams have in common? Each of them has enlisted the recording talents of bassist Will Lee. And of course, you can hear Lee every weeknight with Paul Shaffer on the *Late Show with David Letterman*. With a list of credits that reads like a *Who's Who* of the music industry, he is unquestionably one of the most heard and requested bass players of the 1980s and 1990s.

Now, thanks to his cooperative efforts with the folks at Sampleheads, you can add Will Lee's sound to your sample collection. The *Will Lee Bass Library, Vol. 1* is the first in a 2-volume collection of bass guitar samples on audio compact disc. In the first volume, Lee plays a 1963 Fender Precision (stock), Sadowsky 5-string (custom), APX 4-string, Hamer 12-string, C.F. Martin acoustic, and Hofner 500-1 left-handed Beatle Bass, all from his personal collection. Volume 2 will include fretted and fretless Fender Jazz, Yamaha 5-string acoustic (fretless), Sadowsky 4-string (custom), Spector 4-string, and Pedulla 8-string (fretless with chorus).

Throughout the sample collection, Lee uses different dynamics, feel, and playing styles. If you can't find the kind of bass that you need for your track on one of these compact disks you are probably looking for synth bass.

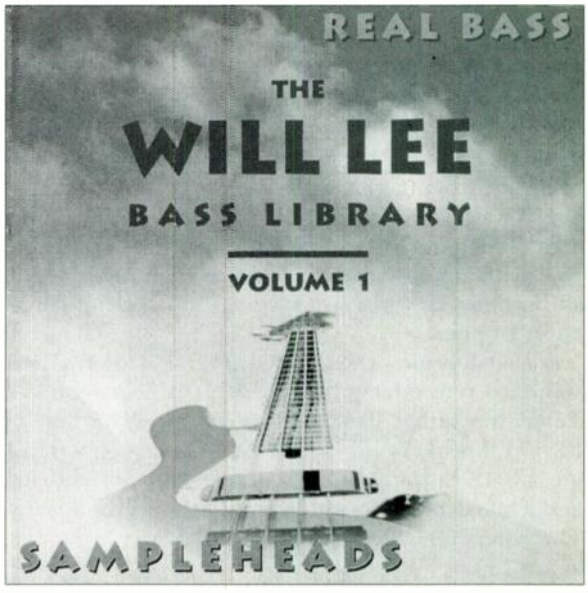
BOTTOMS UP

Each note on the chromatic scale is provided, starting at the lowest note each instrument is capable of playing and going up to the highest (usually around D-4). Each bass is recorded with the nuances Lee feels are appropriate for the playing style of the particular instrument. Each note is sampled at forte and mezzo forte and with different treatments, such as sustained notes, muted notes, string pulls, string slides, x-notes, stops, harmonics, strums, picked, fingered, thumbed, plucked, volume slides, slap—the list goes on.

Thoughtfully included on all samples are the open strings as they appear across the neck of each bass. Only a bass player would know to give you these notes, because bass players know how important they are when playing the real thing.

When first listening to these samples, you could find them quite annoying if you are not used to hearing real bass soloed in a recorded track. The string tone, string buzz, electronics buzz, fret buzz, intonation, finger noise, and pick noise are included. The noises and overtones disappear in the presence of other instruments in a track, and what does not disappear adds character to the performance, making it sound more like a real bassist is in on the session. On some instruments, the noises are included as separate samples, in case you don't have enough noise and want to add more.

All notes in this collection were



In the first volume of Sampleheads' *Will Lee Bass Library*, the world-class bassist plays six of his favorite instruments. The samples include a huge variety of performance nuances.

played and individually picked by Will Lee. I was assured that everything on the CD was played intentionally, including the noises. The focus is on the man playing bass, not the recording technology, although the gear used to produce the CD isn't shabby.

That equipment list includes a Focusrite ISA 110 preamp and 130 compressor, Demeter Tube Direct Box, SSL 6000E recording console, and Digidesign Pro Tools hard-disk recorder. The recording quality complements Will Lee's performance: His sound is full, rich, and well produced.

As an added extra, there are a number of little pieces called "WillLoops." These short little signature licks and effects are performed in a number of different keys and tempos. They include Lee's original licks, licks *à la* Jimi Hendrix and The Ohio Players, and ideas from bass players such as Willie Weeks, Bootsy Collins, and Larry Graham. These could help spark an idea or add a little extra flavor to the bass line that you lay down. A word of warning, though: If you publish anything that uses the non-Lee licks, make sure you're clear of copyright infringement.

THE LOOPING BLUES

The audio CD is packed with so much musical information (over 74 minutes) that it would take hours to sample, truncate, loop, and map all the sounds needed in order to come up with a fully playable performance bank for any one instrument. It's great to have that much material; I'm just saying that you will definitely have a lot of work to do.

Product Summary

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Will Lee Bass Library, Vol. 1
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$99.95
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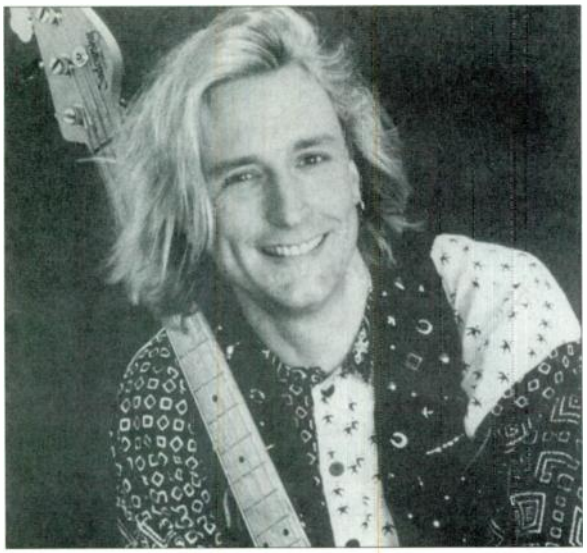
VALUE	● ● ● ◖



Will Lee

The main problem is that because all the sustained notes are around three to four seconds in length, they seem too short for most ballad playing, as well as for up-tempo songs where the notes have to be held. That means manual looping is a necessity, which is hard work with so many notes in each instrument. You can make the looping go a lot faster and easier with a program such as Digidesign's *Sound Designer II*, Passport's *Alchemy*, or better yet, Jupiter Systems' *Infinity* sample-looper. The latter will accelerate the looping process considerably, but it's still going to be a time-consuming encounter. The Will Lee bass collection will be a lot easier to use (and more expensive) when it is offered as pre-looped and mapped samples on CD-ROM.

THE BOTTOM LINE

I found the overall selection and quality of Will Lee's bass sounds most gratifying. It's also extremely helpful that the documentation is clear and accurate and includes a list of index numbers and the absolute program times where each sample is located on the CD.

I am also pleased that unlike most sampling CD manufacturers, Sampleheads and Will Lee are licensing the use of his performances on this CD with the purchase of the product. No additional payments or request for use must be made. However, the documentation jests that "If you put Will Lee on your AF of M [union] contract, he'll love you for it, but you don't have to," and even gives you his Local 802 card number.

It takes work to achieve a bass player-like performance, but it's well worth the time spent. Besides, once you set up the sample map for a particular sampler, you can use it on all subsequent tracks. If you want a real bass player on your tracks but can't afford to hire a superstar like Will Lee, and you have the time for sampling and mapping, buy this CD.

Al Eaton *is a producer/engineer/musician living in the San Francisco/Oakland area. He spends most of his time trying not to get a day gig.*

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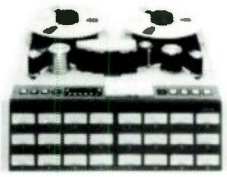

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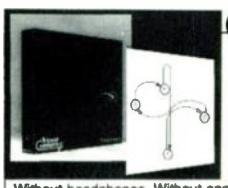
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TECH PAGE

Trion Music

Modeling musical cognition in a computer.

By Scott Wilkinson

No one knows for sure how the brain works, but scientists are trying to figure it out. Among them is a group of researchers at the University of California, Irvine. The team is studying *higher brain function* (HBF), which includes creative and analytical activities, such as music, mathematics, and chess.

HBF occurs in the cortex, which forms the outer surface of the brain. Most of the brain's nerve cells, called *neurons,* are located in this surface layer. The neurons receive, process, and send tiny electrical signals. Each neuron has a single output and thousands of inputs from other neurons. When the combination of input voltages exceeds a certain threshold, the neuron fires a pulse to another neuron.

Amazingly, there are between 10 billion and 100 billion neurons in the brain. Even more amazingly, there are at least 100 trillion connections between neurons. Many researchers believe these connections are used for data storage, which corresponds to over ten terabytes in a 3-pound package you can hold in your hand. The science of neurology is far from being able to unravel the workings of the brain at the level of individual cells, so many researchers use models of brain activity in which groups of neurons work together as a unit.

In one such model, the cortex is organized into basic processing networks called *cortical columns,* each of which is further divided into *minicolumns* of approximately 100 neurons. Each minicolumn is strongly connected to neighboring minicolumns, and some are also connected to distant minicolumns.

The electrical state of each minicolumn varies over time according to the activity of each neuron. Within a column, this behavior is called the *firing pattern,* which depends on the strength of the connections between minicolumns and the timing of the patterns. During HBFs, such as composing music or playing chess, these firing patterns are relatively stable and somewhat periodic, evolving over seconds or minutes.

The UCI team has designed an intriguing computer simulation based on the cortical-column model. They have limited each minicolumn to three electrical states, corresponding to high, average, and low levels of neuron activity. As a result, the minicolumns are called *trions.* Six trions constitute a cortical column in the UCI model (see **Fig. 1**), which gives rise to over half a million firing patterns.

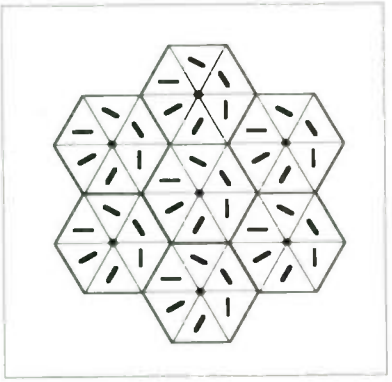


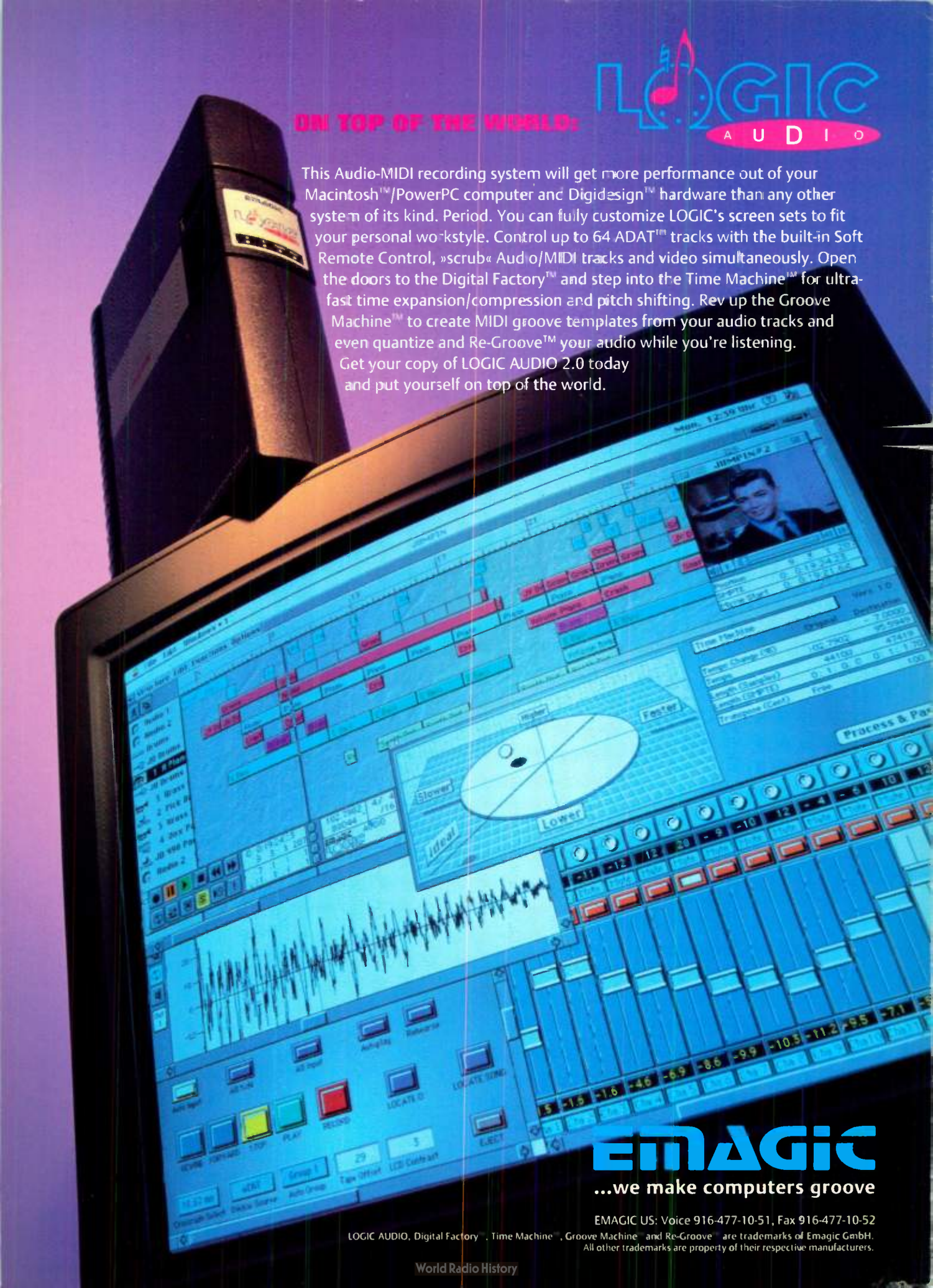
FIG. 1: In this highly schematic representation of the primary visual cortex, each hexagon represents one cortical column of six trions. The trions respond to objects in different spatial orientations as indicated by the bars within each one.

Some of these patterns are more probable than others in the model and in the brain. The most probable patterns correspond to the inherent firing patterns with which we are all born. As we are exposed to different stimuli, such as different types of music, these inherent patterns are enhanced, contributing to our abilities and preferences in all areas of creative and analytic thought.

The UCI team wrote software that steps through firing patterns every 100 ms, calculating each pattern from certain probabilities and the strength of the connections between trions. The software then maps these firing patterns to MIDI note numbers and channels to play notes with different instrumental timbres. The equipment includes a Mac and several Yamaha synths.

This research has yielded many interesting and surprising results. For example, the music generated by the model actually exhibits recognizable cadences and modulations. Different mappings of the same firing patterns produce different "flavors" of music, from waltzes to minuets to certain types of folk music. It is also possible to "teach" the model a musical theme and let it develop variations on that theme.

Although it is the most subjective of all HBFs, music was selected for study because it is highly structured and universally appreciated, even at birth. It is also very time-dependent, which is one hallmark of the trion model. The team hopes to discover common traits between music and other HBFs, leading to a deeper understanding of the brain and how it works in all its myriad tasks.



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